Adaptation metrics and resilience metrics

Implication for development actors

Stephane Hallegatte

Climate Policy Group

The World Bank

The World Bank Group monitors adaptation finance using the MBD methodology

- Context of vulnerability to climate variability and change
- Statement of purpose or intent
- *Clear* link between climate vulnerability and project activities
- Only the *relevant* component(s) of a project are accounted for.

We capture a subset of our actions to reduce future impacts of climate change

- Some projects can be made more resilient and better adapted to climate change at no additional cost

- Some projects can increase resilience and adaptation capacity massively, but only in an *indirect* manner.

Replacing bridges with less brittle river-crossing sills (AFD in Vanuatu)

SHOCK WAVES

Managing the Impacts of Climate Change on Poverty

In the absence of climate change, we can imagine two different ways for the world to evolve

Prosperity
More optimistic on:
- Economic growth
- Poverty
- Inequality
- Basic services

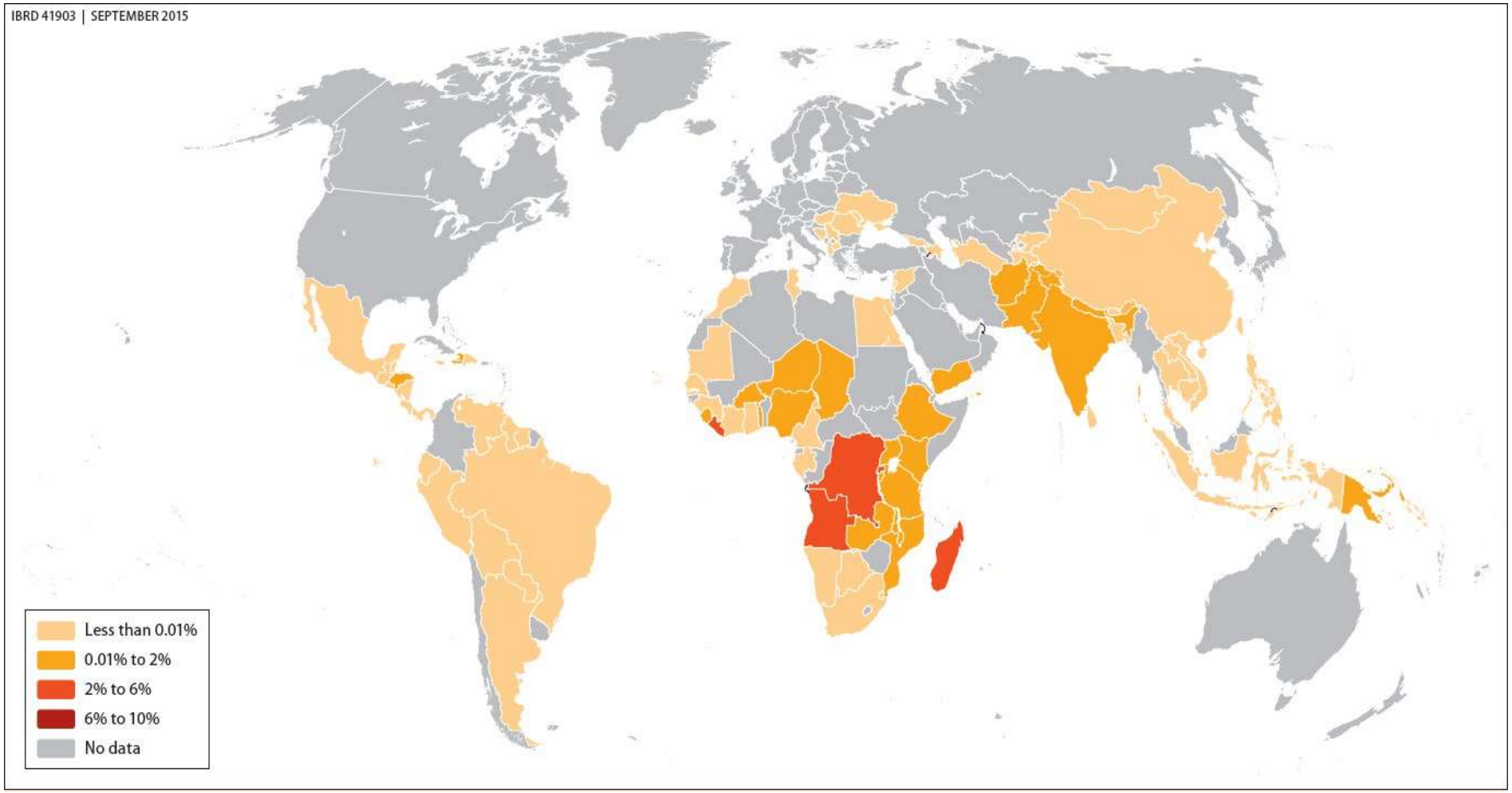
Poverty
Less optimistic on:
- Economic growth
- Poverty
- Inequality
- Basic services

Then, we introduce climate change in these two scenarios.

And we explore what development can achieve to reduce future climate change impacts

“Good development” can prevent most of the impact of climate change on poverty, until 2030

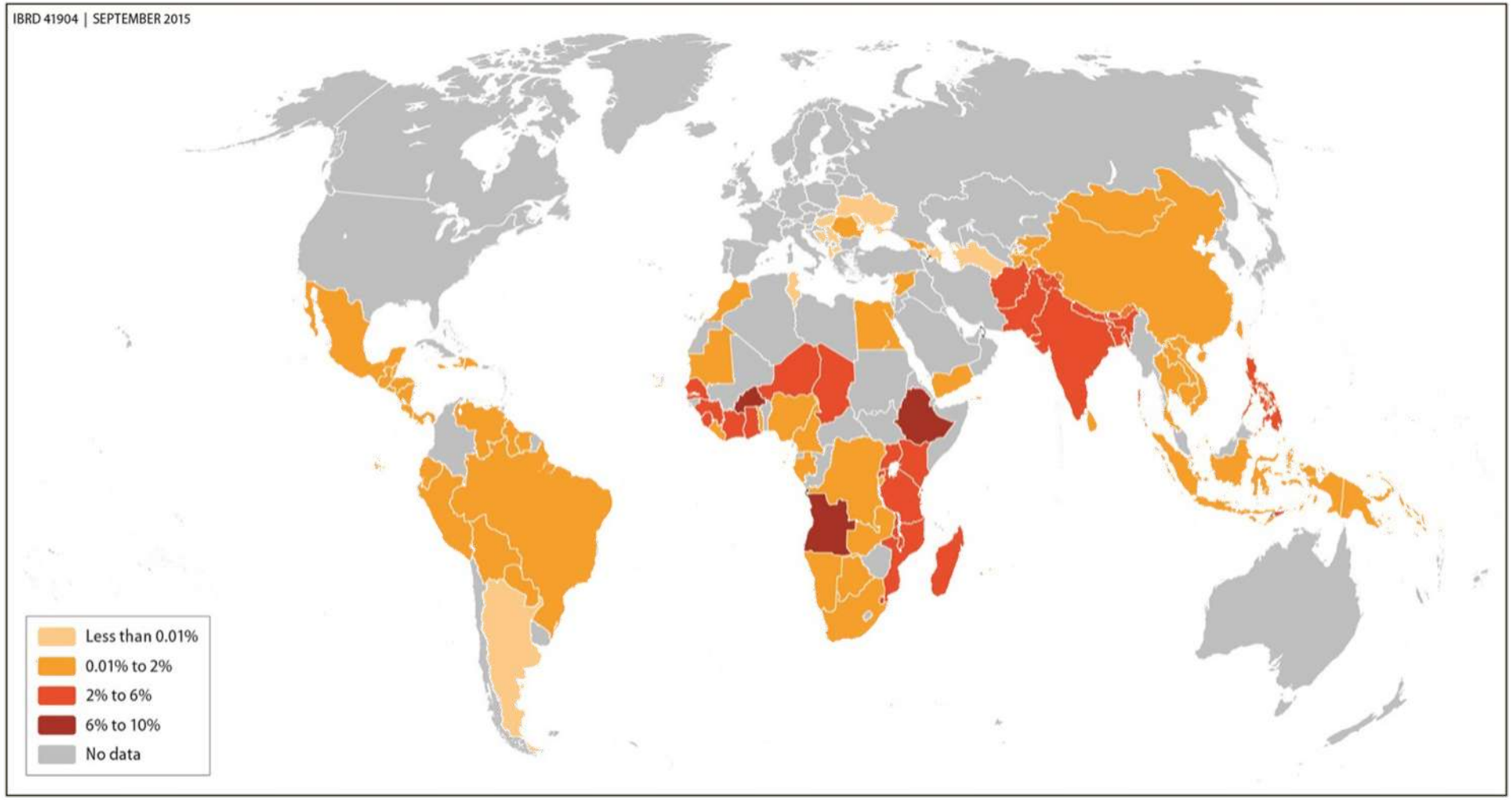
Prosperity Scenario



Up to 16 Million more people below the poverty line in 2030 due to climate change

Absent good development, climate change could keep more than 100 million people in poverty

Poverty Scenario

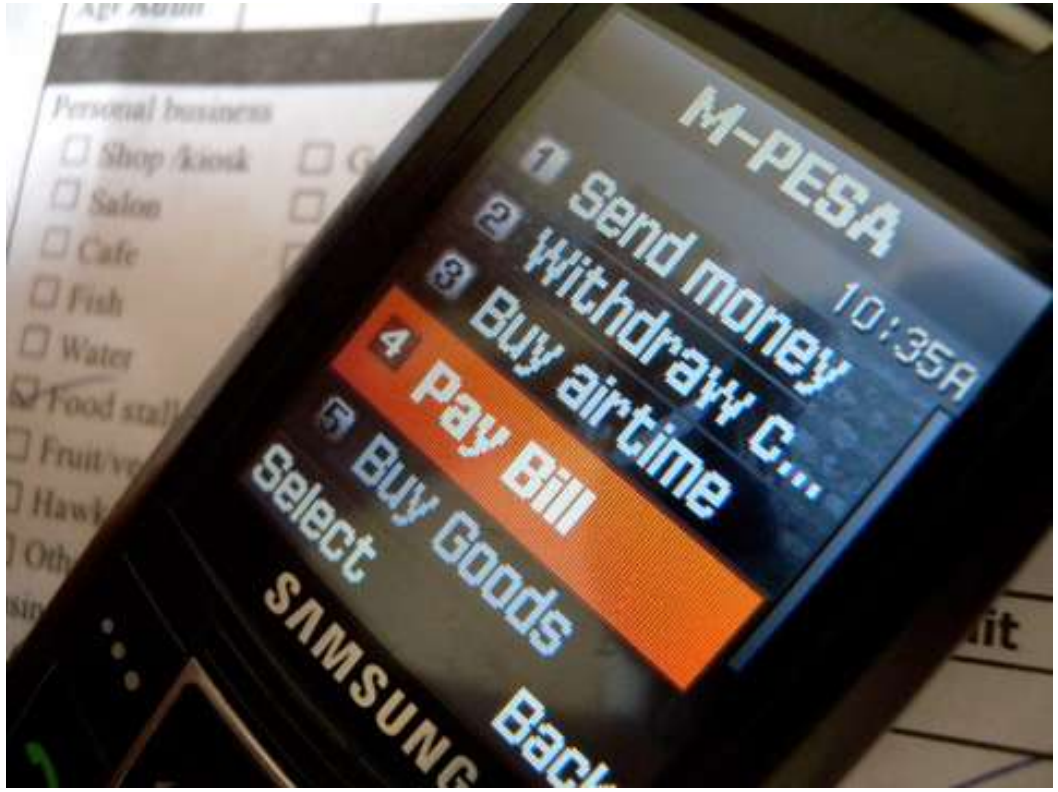


Up to 122 million more people below the poverty line in 2030 due to climate change

Good development includes progress in the agricultural sector and infrastructure

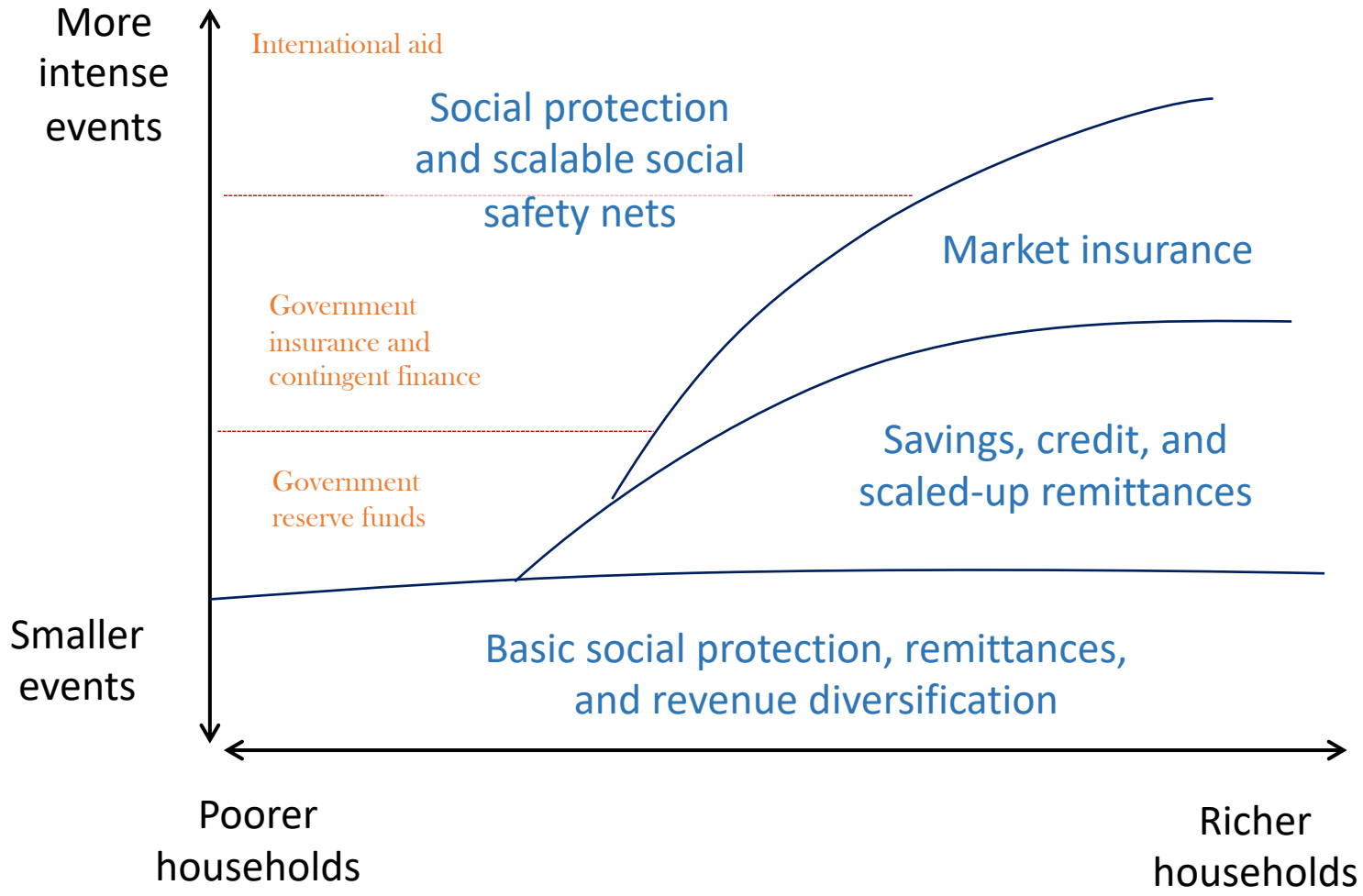
Better education, transport infrastructure, and connection to markets can reduce climate change impacts through agriculture

Good development includes financial inclusion that protects people against all shocks…



- Mobile banking will help.
- But bank account must be designed for poor people…
- … and they need consumer protection.

Good development includes strengthened social protection systems that can respond to shocks



Good development includes universal heath coverage and better health care quality…

In Rwanda, the government started investing in universal health coverage in 1994. Today nearly 80 percent of its population is insured.

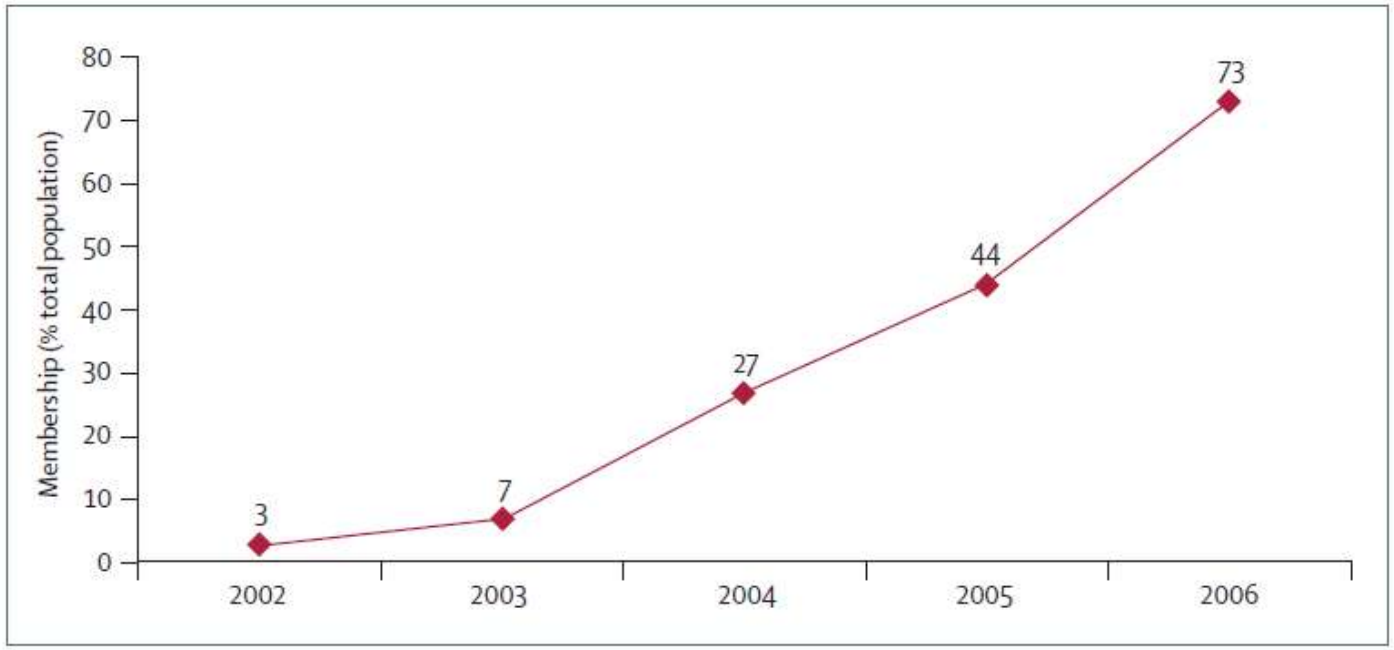


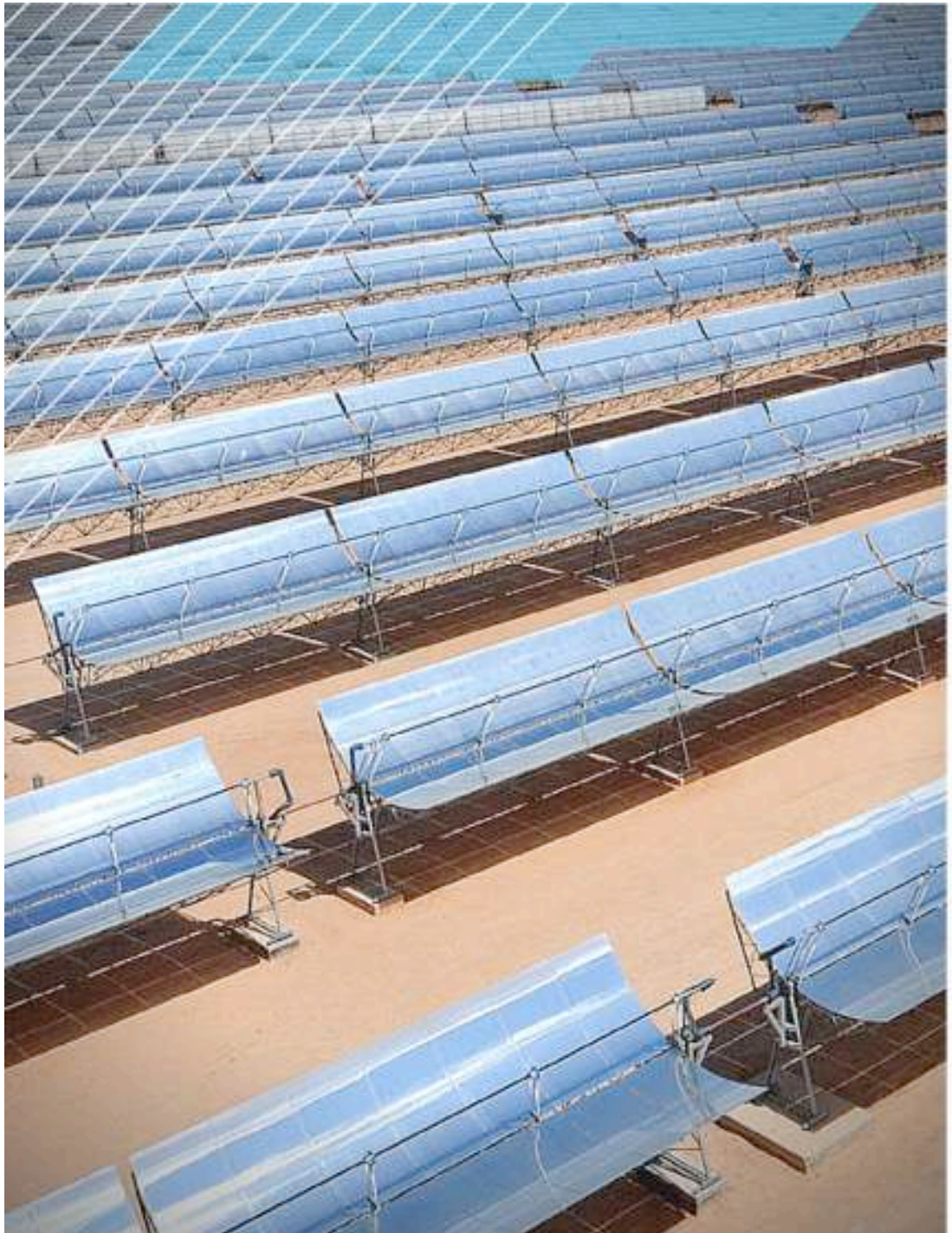
Figure 3: Scale-up of community-health insurance scheme
Reproduced from Basinga and colleagues with permission.[18]

Source: Logie, Rowson, and Ndagije, The Lancet

“Climate-smart” development is extremely efficient to reduce future impacts of climate change, but it is not accounted for in our reporting on adaptation finance

This is why we are working on resilience metrics, going beyond adaptation – released planned in November, during the COP

This is why our Climate Change Action Plan goes beyond an increase in commitment



THE WORLD BANK GROUP

Climate Change Action Plan

April 7, 2016

WORLD BANK GROUP
Climate Change

To enable global transformation, the Action Plan **has four priorities**

High level objective

The WBG contributes to sustainable poverty alleviation and shared prosperity by building resilience to climate change impacts and policies and decarbonizing development

Priority I:
Support Transformative Policies and Institutions.

Priority II:
Leverage resources.

Priority III:
Scale Up Climate Action

Priority IV: Align internal process and work with others

Foundation – the WBG core business of promoting development and poverty reduction

Measuring adaptation inputs and impacts

Emerging experience from financing institutions

Dr Craig Davies
Head of Climate Change Adaptation, EBRD

Metrics of Adaptation Conference: Measuring Adaptation for Concrete Action
COP22 Preparatory Conference, Skhirate, 27September 2016

European Bank
for Reconstruction and Development

Measuring Adaptation Impacts – KfW Approaches and Lessons Learnt

Josef Haider
Climate & Energy Policy Unit
KfW Development Bank

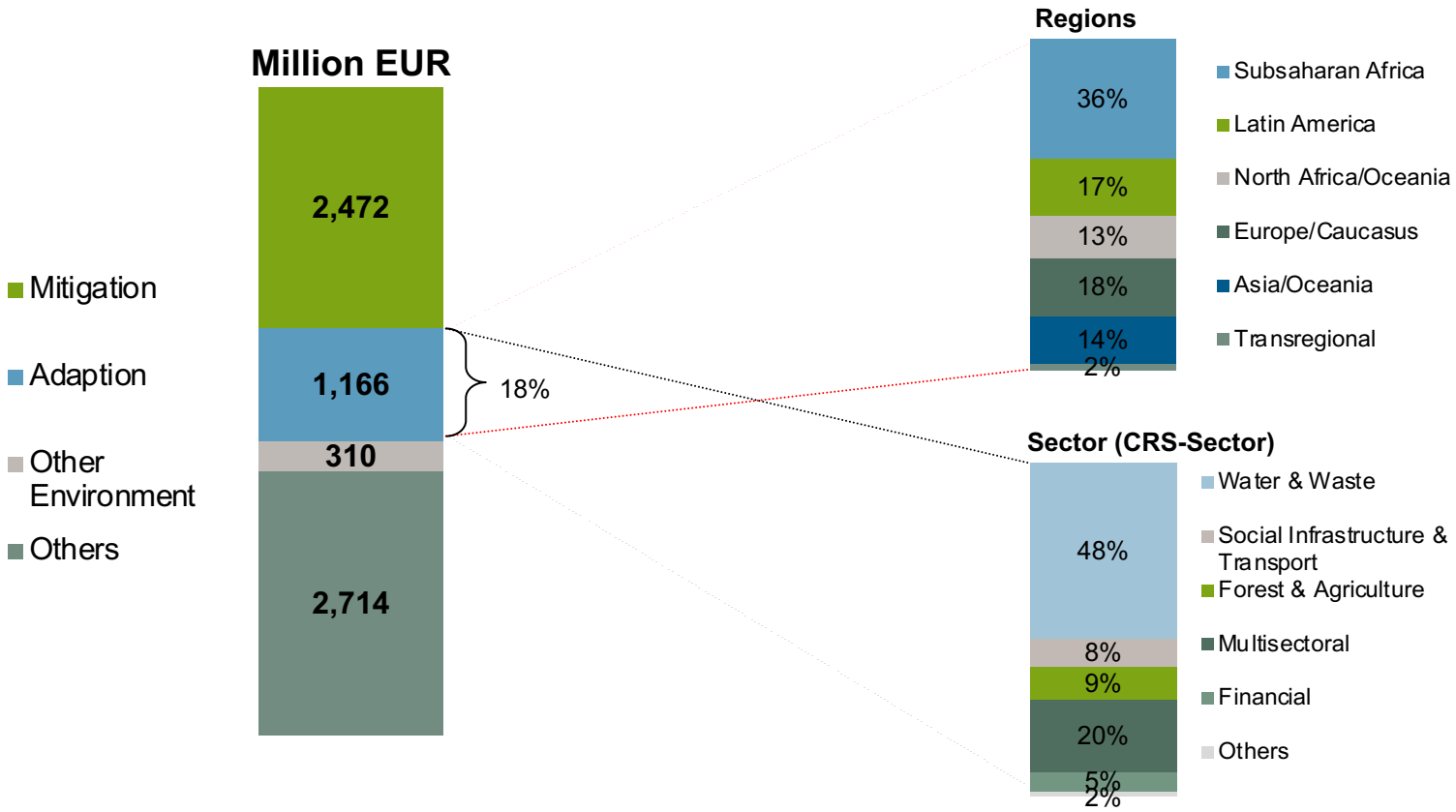
Metrics of Adaptation Conference
Rabat, Morocco – 27 September 2016

Bank aus Verantwortung

KFW

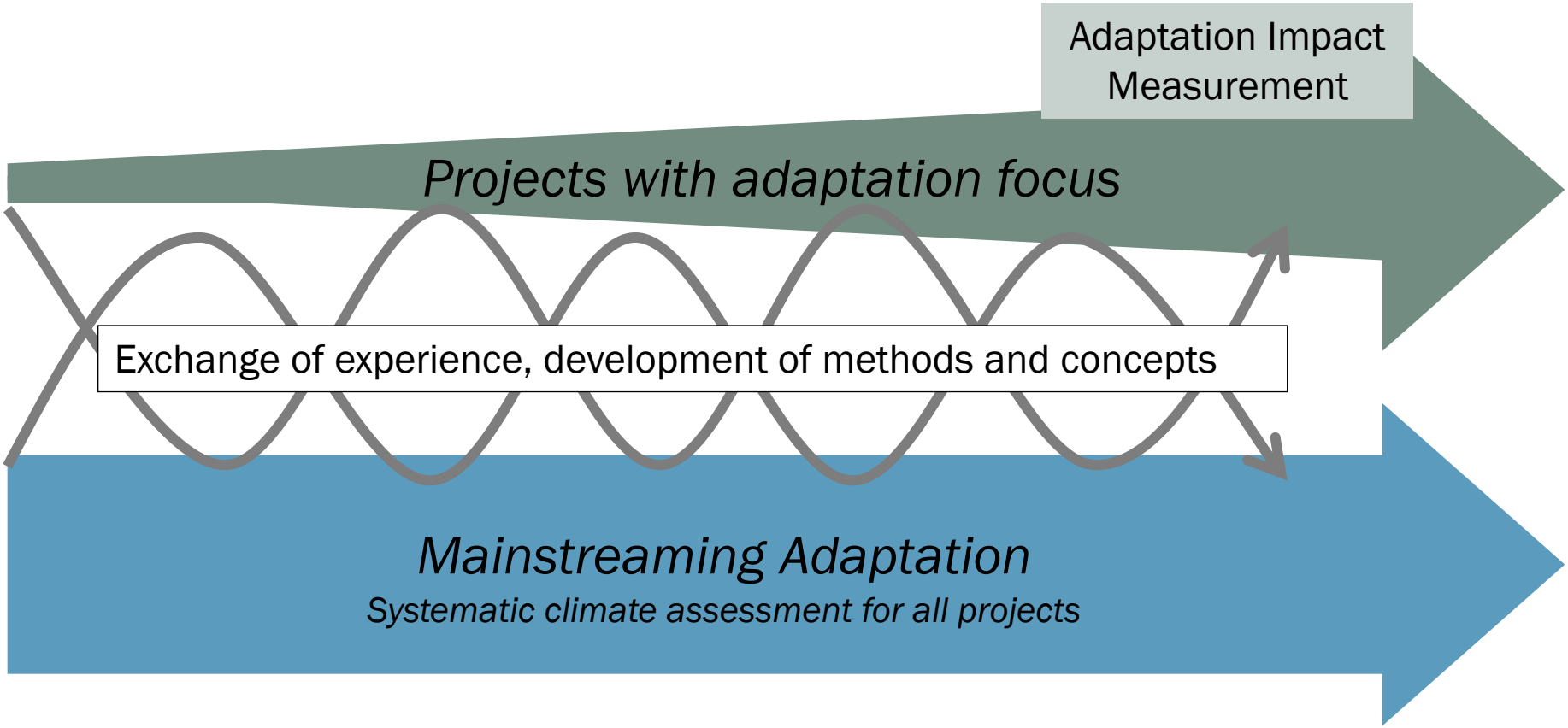
Commitments for environment and climate

Commitments 2015 – adaptation by sectors and regions



The major part of adaptation commitments are in the Subsaharan Africa region. Projects are mainly in the water and waste sector.

››› Our Approach to Adaptation



››› Adaptation Impact Monitoring (AIM) for Specific Adaptation Projects

	Projects with Adaptation as a Principal Objective (CCA 2)	Projects with Adaptation as a Significant Objective (CCA 1)
Project Level	➢ AIM using project-specific impact indicators	➢ Adaptation monitoring only at output level
Beyond Project Level	➢ AIM using an aggregated indicator *	➢ AIM using an aggregated indicator *

* Methodology under development

Main Purpose of Adaptation Impact Measurement

Prove / Quantify Impact on Climate-Related Resilience of People (incl. Lifelihoods) or Ecosystems

››› KfW´s Adaptation Impact Monitoring at Project Level

- Using indicators proving/quantifying impact on climate-related resilience
- We provide a set of indicators for the most relevant CCA project types

  - Agriculture and Rural Development
    - Irrigation
    - Soil and water conservation
    - Climate smart agriculture
    - Agricultural insurance
    - Climate resilient rural infrastructure
  - Natural Resources Management and Biodiversity
    - …
  - Water Supply and Sanitation
    - …
  - Coastal & Flood Protection / (Climate-related) Disaster Risk Management
    - …
  - Climate Risk Insurance and Transfer
    - …

- For projects with CCA as a significant objective (CCA 1) ⇒ Indicators at the output level (no impact monitoring!)

KfW´s Adaptation Impact Monitoring Beyond Project Level

- Methodology under development 
- Indicator „Number of people with increased resilience“
  - For all adaptation projects (CCA2 & CCA1)
  - Considering only directly benefitting people
- Without accounting for different levels of increase in resilience

››› Lessons Learnt

- Adaptation (impact) is highly context-specific: We do need project-specific impact indicators!
- Meaningful impact indicators at the project scale are difficult to identify ⇒ Exchange best practices
- Indicators going beyond the project scale are useful, but cannot provide full comparability ⇒ measuring the overall progress towards „the global goal on adaptation“ is hardly possible
- One of the most promising indicators: „Number of people with increased resilience“. But: Focus on directly benefitting people!
- Important to consider practicability and cost!

››› Contact Details

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Measuring adaptation inputs and impacts

Emerging experience from financing institutions

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European Bank
for Reconstruction and Development

Measuring adaptation inputs and impacts

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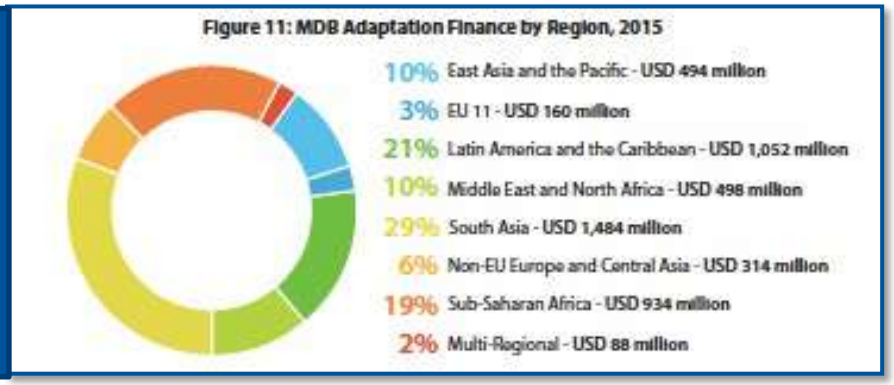
for Reconstruction and Development

Adaptation (and mitigation) inputs can be measured in monetary terms ($)



Mitigation impact can be measured in tCO_2 reductions – *comparable* and *aggregatable*

But how can we measure adaptation impact?

Impact metrics within projects & sectors

European Bank
for Reconstruction and Development

Project-specific metrics

- km of coastline protected
- km of dykes refurbished
- Improved climate risk management practices adopted

Highly project-specific reflecting the context-specific nature of adaptation

Not useful for comparing or aggregating adaptation impacts across projects

Sector-specific metrics

Irrigation projects

- Reduced water consumption (km^3/year)
- Increased crop yield per unit water used ($/$m^3$)

Port projects

- Reduced downtime due to extreme weather events (days/year)
- Reduced damage due to extreme weather events ($/yr)

Weak on context-specific nature of adaptation

Comparable/aggregatable within sectors, but not across sectors

Impact metrics across sectors

European Bank
for Reconstruction and Development

No. of people made more climate-resilient

Used by GCF, CIF, GEF

Comparable and aggregatable across projects and sectors

Difficulties:

- Project boundaries
- No. of beneficiaries
- Exact meaning of 'more resilient'

Value ($) of assets made more climate-resilient

Being considered by MDBs

Comparable and aggregatable across projects and sectors

Difficulties:

- Project boundaries
- Impact on 'real' climate resilience outcomes

Index-based adaptation impact metric

Qualitative rating of project climate resilience scored against a best-practice process

Rating indices already used by MDBs etc.

Examples at country-level but not at project level

Impact metrics within projects & sectors

European Bank
for Reconstruction and Development

Project-specific metrics

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Weak on context-specific nature of adaptation

Comparable/aggregatable within sectors, but not across sectors

European Investment Bank

Rasmus Lauridsen

PJ/ECSO - Environment, Climate and Social Office

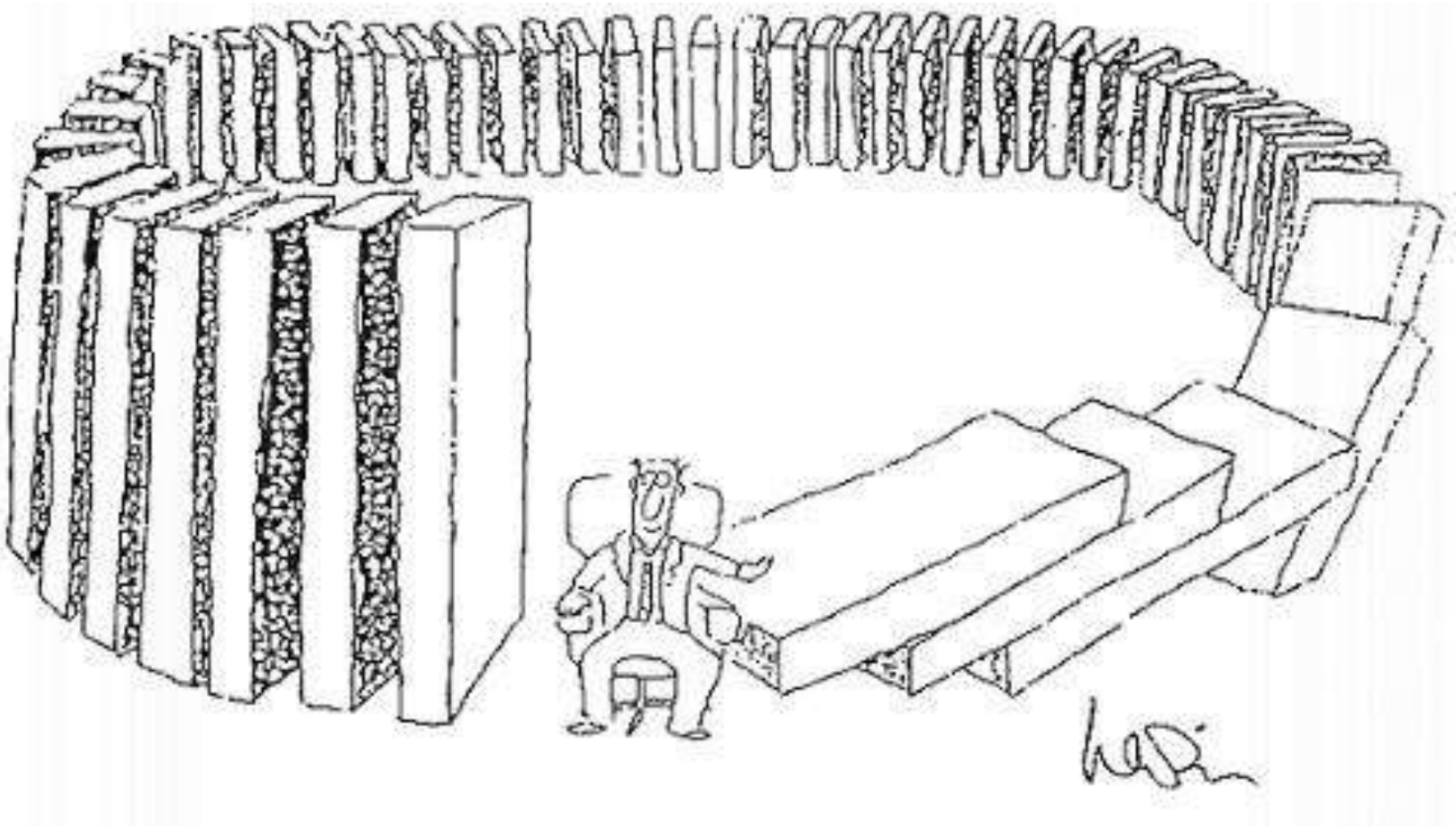
Climate Resilient Development

Lessons from measuring development

Rabat 27 September 2016

European Investment Bank

Climate change is happening and humans caused it!

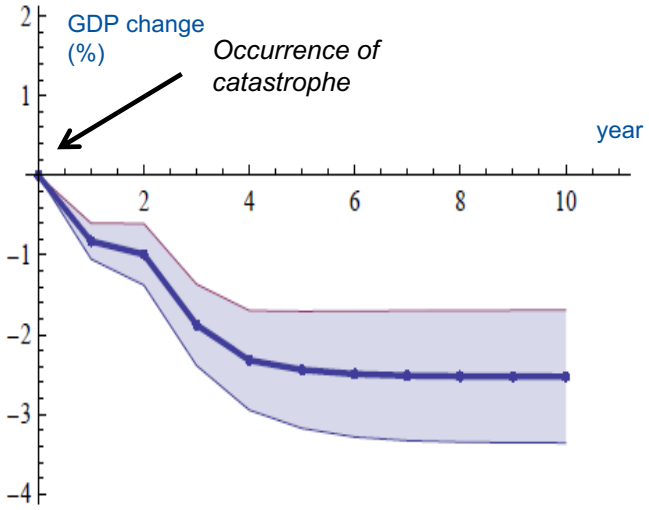


Climate Resilience in Development

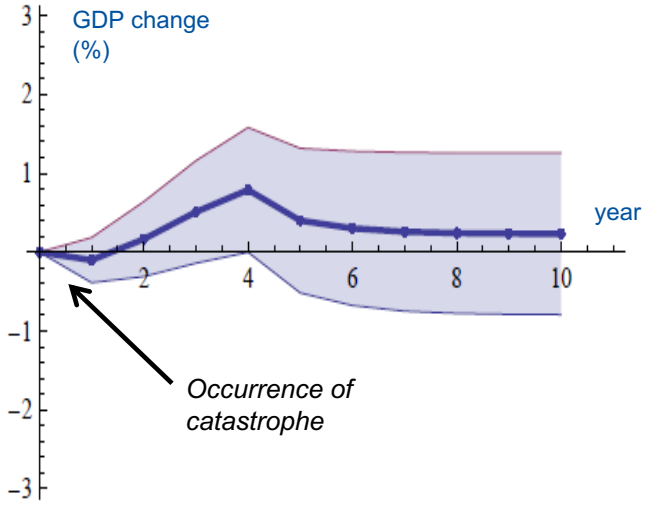
Ex-ante: vulnerability and risk information; loss-prevention measures

Ex-post: recovery financing and resilience-building support

Cumulative effect on GDP in the case of a completely uninsured catastrophe event



Cumulative effect on GDP in the case of a fully insured catastrophe event



Thoughts on Climate and Development Indictors

- When development interventions began we did not really **know what worked on economic growth** – we have been measuring for over half a century now
- But **if you don't measure it you can't manage it** – we have done it before and so we shall again for climate
- 20 years ago EIAs were rare and questioned - today they are **simply good practice** as we have established they are part and parcel of good and sustainable development
- Resilience indicators may therefore be **transitory**, while impact indicators are always going to be **long term**

Considerations on the pathway

- We still have scant knowledge of where the best **Bang for the Buck is** – we need Economics of Adaptation or CBA equivalent "**An ounce of prevention is worth a pound of cure"**
- We must be willing and able to accept maladaptation resilience is not binary "**if you don't fail you are not trying hard enough**".
- As FACEBOOK mantra says "**Move fast and break things**" - we need to measuring what works and delivers impact and give bang for the buck to **ensure sustainable development for billions of people and trillions in development assets**.

European Investment Bank

Adaptation metrics for the financial sector

Conference on Adaptation Metrics
Skhirate, September 27, 2016

développeur d'avenirs durables

Why tracking adaptation finance for a DFI?

- **Operational objectives**
  - Mainstreaming and efficiency
- **Transparency objectives**
  - Comparability of measurement method
- **Accountability objectives**
  - International accountability towards UNFCCC and stakeholders
- **Communication objectives**
  - Avoid green washing

IDFC-MDBs Common principles on adaptation finance tracking

- Various methodologies, but harmonization process leading to convergence on principles
- 3 steps approach (purpose, context and activity based)
  - Statement of intent
  - Set out the context of vulnerability to CC
  - Link the project activity to the context of vulnerability
- Disaggregate from non adaptation activities as much as possible
- Follow a conservative approach

Limits and challenges : why do we need adaptation/resilience metrics ?

- **Finance tracking vs. impact monitoring**
  - Quality control of adaptation finance
  - Incentivize capacity building and knowledge production/sharing
- **Adaptation is a process**
  - Go beyond the project approach
  - Evaluate the leverage effect on mainstreaming
- **Contribute to resilient development pathways**
  - Operationalize NDCs
- **Access to international finance**
  - Prepare better (substantiated and justified) adaptation programs

Work in progress at AFD

- **New climate strategy (2017-2020)**
  - Work on internal processes and tools
- **Need to better understand the needs**
  - Analysis grid on policies and processes of countries
  - Position the technical dialogue and the financial support on the right sectors and topics
- **Need to better assess the impacts**
  - Indicators on contribution to the transformative process of resilience
  - Gradual and qualitative

La métrique au cœur du dispositif d'évaluation des risques climatiques

Skhirat, le 27 septembre 2016

Le Maroc : Un pays à l'avant-garde de la couverture des risques climatiques en Afrique

- La couverture du risque sécheresse pour le monde agricole : Plus de 1 million d'hectares couverts.
- Assurance « multirisque climatique » : Garantit les récoltes relatives aux cultures céréalières et légumineuses contre un ensemble de risques climatiques:
  - (sécheresse, excès d'eau, grêle, gel, vent violant et vent de sable).

Couverture des risques catastrophiques

Estimation des pertes dues à certains risques au Maroc (en millions de MAD)

Risque	Exposition	Annual Average Loss (AAL)	Probable Maximum Loss (PML/100 ans)
Inondation	2 700 000	4 177	27 556
Tremblement de Terre	2 700 000	850	15 317
Tsunami	2 700 000	124	404
Sécheresse (blé dur, blé tendre et orge)		2 696	17 367
Total		7 848	Pas directement cumulable

***Source** : Groupe Banque mondiale (2013). Renforcement de la résilience du Maroc : apports pour une stratégie de gestion intégrée des risques.*

L'analyse probabiliste des risques de catastrophes naturelles révèle que le coût moyen annuel des catastrophes naturelles est de **7,8 milliards MAD**.

***Exposition:** Résidentielle, Commerciale, Industrielle, Bâtiment Govt, Installations essentielles (lignes de transmission d'énergie, installations électriques, conduites de Gaz, Conduites d'eau, Réseau d'eau usée,….), Infrastructure.*

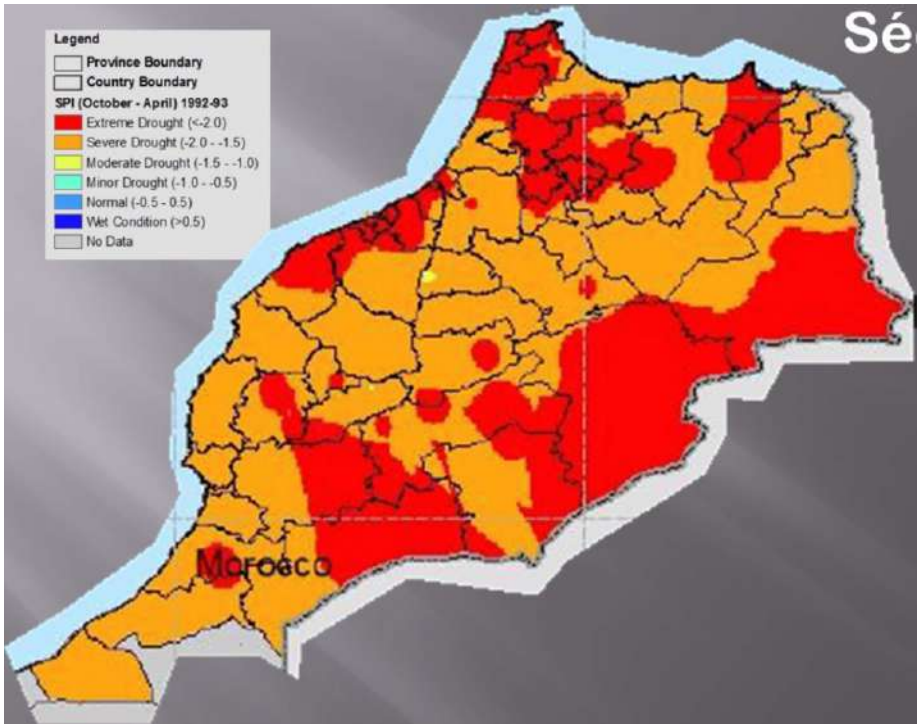
***(*):** Les montants n'incluent pas les dommages corporels*

Le risque sécheresse

Assurance paramétrique: risque sécheresse

- La sécheresse est un sérieux problème pour le Maroc, qui risque d'empirer avec le changement climatique.

- La sècheresse touche en priorité le secteur agricole, lequel contribue à **15% du PIB** et emploie environ **40 % de la population active** marocaine.



Source *: Groupe Banque mondiale. Renforcement de la résilience du Maroc : apports pour une stratégie de gestion intégrée des risques.*

- L'indice «Standardized Precipitation Index (SPI)*» peut être utilisé comme indice dans l'assurance paramétrique
  - Il est calculé à différentes échelles de temps permet notamment d'identifier:
    - ✓ la sécheresse météorologique,
    - ✓ son intensité et
    - ✓ sa probabilité d'occurrence

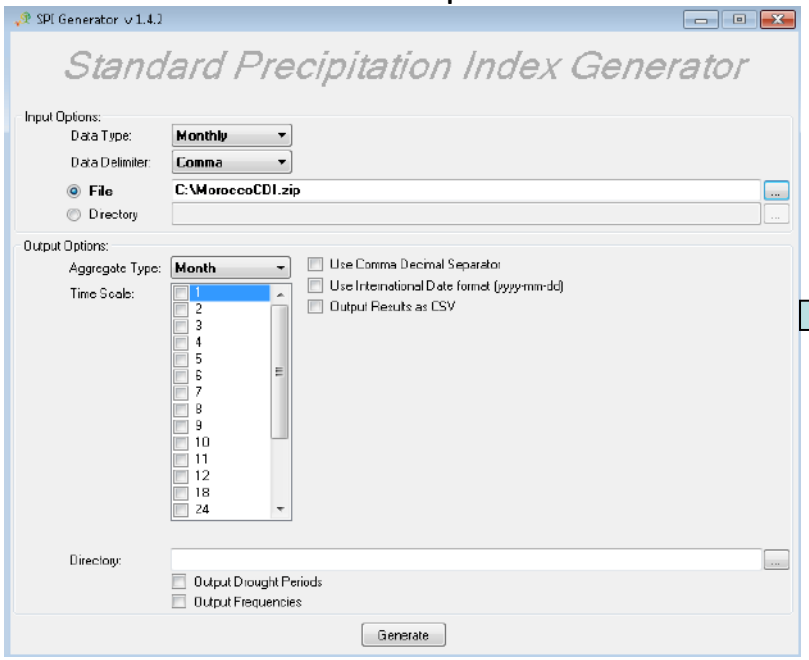
(*): *développé par Tom McKee et al.(1993),*

Assurance paramétrique: risque sécheresse

الجامعة المغربية لشركات التأمين و إعادة التأمين
FEDERATION MAROCAINE DES SOCIETES D'ASSURANCES ET DE REASSURANCE

Calcul du SPI

Données d'entrée : Précipitations



date	spi1	spi2	spi3	spi4	spi5	spi6	spi12
01/01/1981	-1.68	-99	-99	-99	-99	-99	
02/01/1981	-0.84	-1.71	-99	-99	-99	-99	-99
03/01/1981	-0.41	-1.01	-1.68	-99	-99	-99	-99
04/01/1981	2.15	1.38	0.67	-0.12	-99	-99	-99
05/01/1981	0.35	2.04	1.33	0.68	-0.09	-99	-99
06/01/1981	0.02	0.3	2.05	1.35	0.69	-0.1	-99
07/01/1981	0.09	0.01	0.3	2.06	1.35	0.69	-99
08/01/1981	0.02	0	-0.02	0.29	2.07	1.36	-99
09/01/1981	-0.77	-0.78	-0.8	-0.9	-0.23	1.97	-99
10/01/1981	-0.89	-1.01	-1.01	-1.01	-1.06	-0.95	-99
11/01/1981	-2.14	-2.16	-2.27	-2.26	-2.26	-2.26	-99
12/01/1981	0.2	-1.08	-1.39	-1.45	-1.44	-1.44	-1.13
01/01/1982	0.25	0.17	-0.55	-0.72	-0.74	-0.74	-0.29
02/01/1982	0.38	0.26	0.16	-0.51	-0.71	-0.73	-0.21
03/01/1982	-0.54	-0.13	-0.06	0.01	-0.64	-0.84	-0.28
04/01/1982	0.07	-0.42	-0.2	-0.13	-0.06	-0.75	-0.95
05/01/1982	-0.87	-0.36	-0.72	-0.46	-0.3	-0.16	-1.05
06/01/1982	-0.72	-1.03	-0.43	-0.78	-0.51	-0.33	-1.07
07/01/1982	2.53	-0.41	-0.98	-0.41	-0.77	-0.5	-1.06
08/01/1982	0.53	1.37	-0.34	-0.99	-0.41	-0.77	-1.06
09/01/1982	-1.21	-1.17	-1.08	-1.41	-1.69	-0.79	-1.1
10/01/1982	-1.08	-1.27	-1.26	-1.24	-1.34	-1.7	-1.15
11/01/1982	0.36	-0.18	-0.31	-0.31	-0.3	-0.33	-0.4
12/01/1982	-1.2	-0.59	-0.97	-1.06	-1.06	-1.05	-1
01/01/1983	-1.76	-1.66	-0.66	-0.85	-0.88	-0.88	-0.68
02/01/1983	0.45	-0.58	-1.1	-0.58	-0.8	-0.84	-0.83
03/01/1983	-0.99	-0.23	-1.01	-1.27	-0.77	-0.99	-0.98
04/01/1983	0.14	-0.58	-0.26	-0.96	-1.28	-0.87	-1.22
05/01/1983	-0.62	-0.22	-0.81	-0.47	-1.09	-1.34	-1.2
06/01/1983	-0.52	-0.75	-0.27	-0.87	-0.52	-1.12	-1.2
07/01/1983	-0.65	-0.56	-0.76	-0.28	-0.87	-0.52	-1.21
08/01/1983	0	-0.28	-0.57	-0.79	-0.28	-0.88	-1.21
09/01/1983	-1.68	-1.65	-1.68	-1.89	-1.66	-0.7	-1.24
10/01/1983	-1.71	-1.93	-1.93	-1.93	-2.01	-2.17	-1.35
11/01/1983	0.96	0.34	0.22	0.22	0.22	0.2	-0.94
12/01/1983	-0.18	0.41	-0.05	-0.15	-0.15	-0.15	-0.68
01/01/1984	-1.42	-0.65	0.13	-0.16	-0.22	-0.22	-0.23
02/01/1984	-0.38	-1.23	-0.81	-0.02	-0.32	-0.37	-0.47
03/01/1984	0.06	-0.39	-1.06	-0.76	-0.06	-0.36	-0.42
04/01/1984	-1.08	-0.75	-1.01	-1.56	-1.1	-0.31	-0.75
05/01/1984	2.05	0.45	0.24	-0.16	-0.77	-0.68	-0.42
06/01/1984	1.18	2.17	0.51	0.29	-0.13	-0.74	-0.4
07/01/1984	1.09	1.2	2.18	0.52	0.3	-0.12	-0.4
08/01/1984	-0.13	0.32	1.14	2.21	0.51	0.3	-0.4
09/01/1984	-1.63	-1.61	-1.57	-0.98	1.67	0.18	-0.41
10/01/1984	-1.38	-1.62	-1.62	-1.61	-1.49	-0.24	-0.39
11/01/1984	0.97	0.4	0.28	0.28	0.28	0.3	-0.43
12/01/1984	-1.02	0.07	-0.36	-0.46	-0.46	-0.46	-0.77
01/01/1985	0.91	-0.15	0.38	0.1	0.05	0.05	0.04
02/01/1985	0.68	0.92	-0.01	0.45	0.17	0.11	0.16
03/01/1985	-1.18	-0.06	0.47	-0.25	0.27	-0.01	0.02
04/01/1985	1	0.1	0.4	0.75	-0.08	0.4	0.28

La classification du SPI selon Lloyd-Hugues et al.(2002) :

VALEUR SPI	CATÉGORIE
≥ 2	Extrêmement humide
1.50 à 1.99	Très humide
1.00 à 1.49	Modérément humide
0.00 à 0.99	Légèrement humide
0.00 à -0.99	Légèrement sèche
-1.00 à -1.49	Modérément sèche
-1.50 à -1.99	Très sèche
≤ -2.00	Extrêmement sèche

Nécessité d'un nombre suffisant de stations météorologiques

Assurance Paramétrique: risque sécheresse

Une classification du SPI adaptée au cas marocain peut se faire comme suit:

Valeur SPI	Type de Sécheresse	Coef. d'Indemnisation (exemple)
-0,67 à -1,49	Modérée	25%
-1,5 à -1,99	Sévère	50%
≤ -2	Extrême	75%

Cas pratique d'application du SPI dans la région de Meknès

- L'estimation des valeurs du SPI permet:
  - d'identifier les **périodes vulnérables** qui représentent une importante corrélation avec les rendements et
  - de calculer les **probabilités d'occurrence de la sécheresse** dans ses différents degrés d'intensité (sécheresse modérée, sévère ou extrême)

✓ **La période vulnérable**

Province	Période vulnérable	Corrélation SPI/Rendement
Meknès	Octobre-Mars	78%

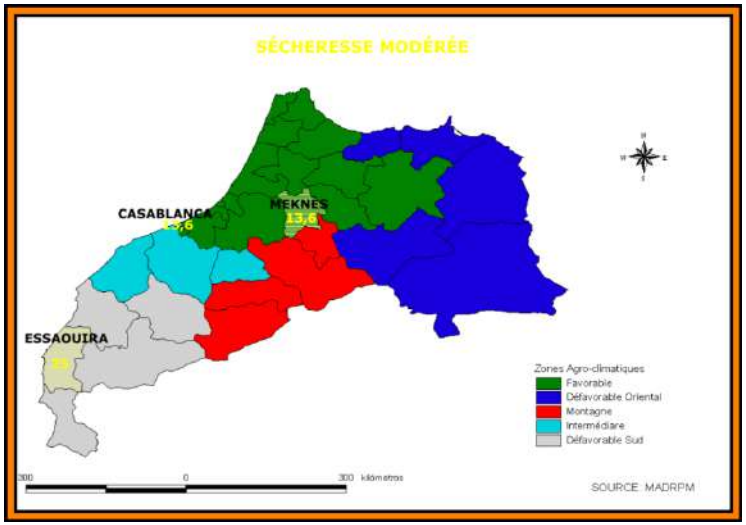
La corrélation maximale entre le SPI et le rendement marque la période vulnérable.

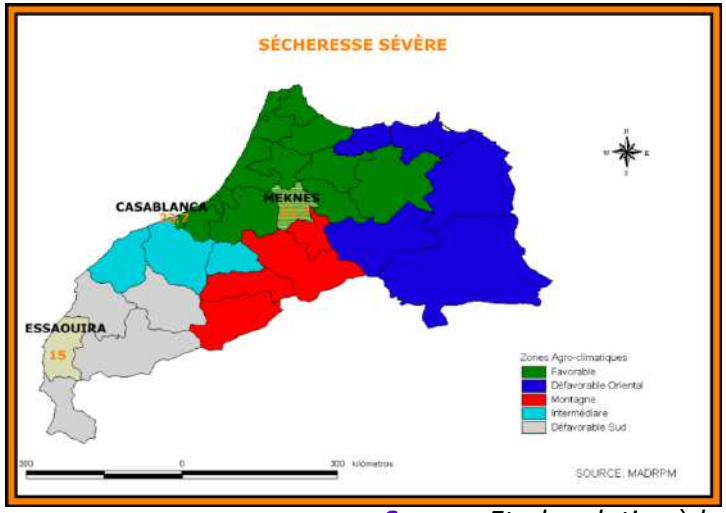
Assurance Paramétrique: risque sécheresse

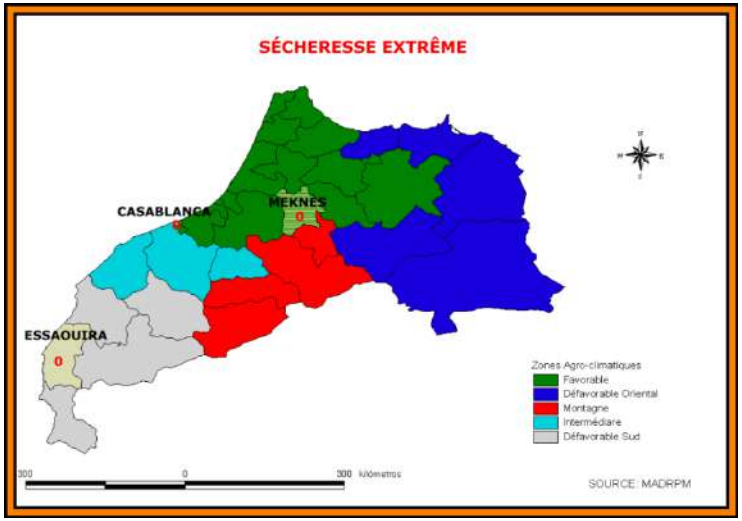
Cartes du risque sécheresse

- Représentation du profil de risque de la sécheresse (en termes de probabilités) dans des cartes de risque, selon la sévérité de la sécheresse.

- La probabilité pour que la culture, dans la zone de Meknès (zone favorable), souffre d'une sécheresse modérée est de **13.6%,** tandis que la probabilité pour que la sécheresse soit grave est de **22.7%**







Source: *Etude relative à la coopération Maroc-Espagne*

Le risque inondations

Assurance des risques inondations

- Les inondations constituent un phénomène très lié au Changement Climatique
- Les inondations sont devenues de plus en plus fréquentes
- Aggravation des dégâts par le fort développement socio-économique, industriel, agricole etc.

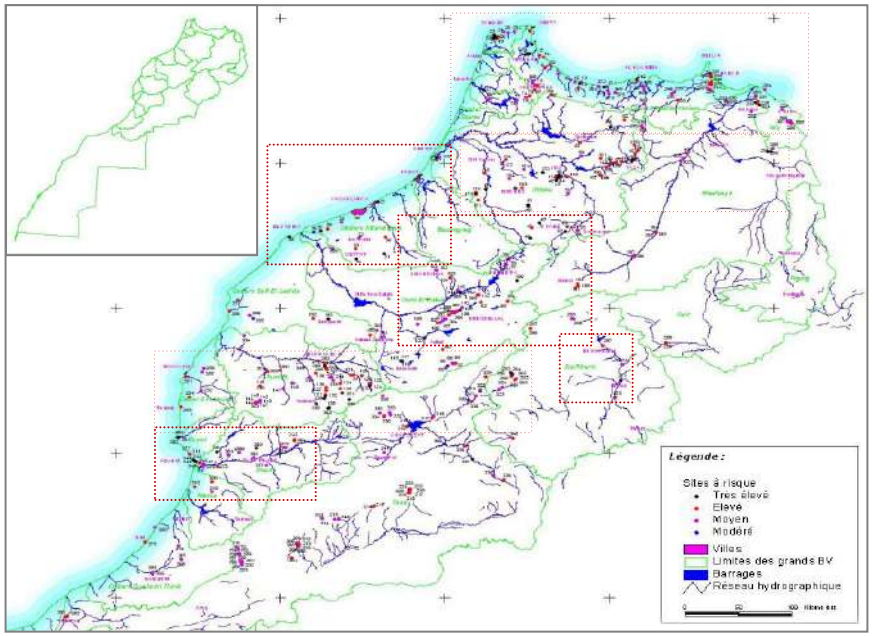
Sites potentiellement exposés aux inondations:

Au Maroc **391 sites** ont été répertoriés comme sites inondables (selon le Plan National de la Protection contre les Inondations: PNPI):

Bassins Versants (BV)

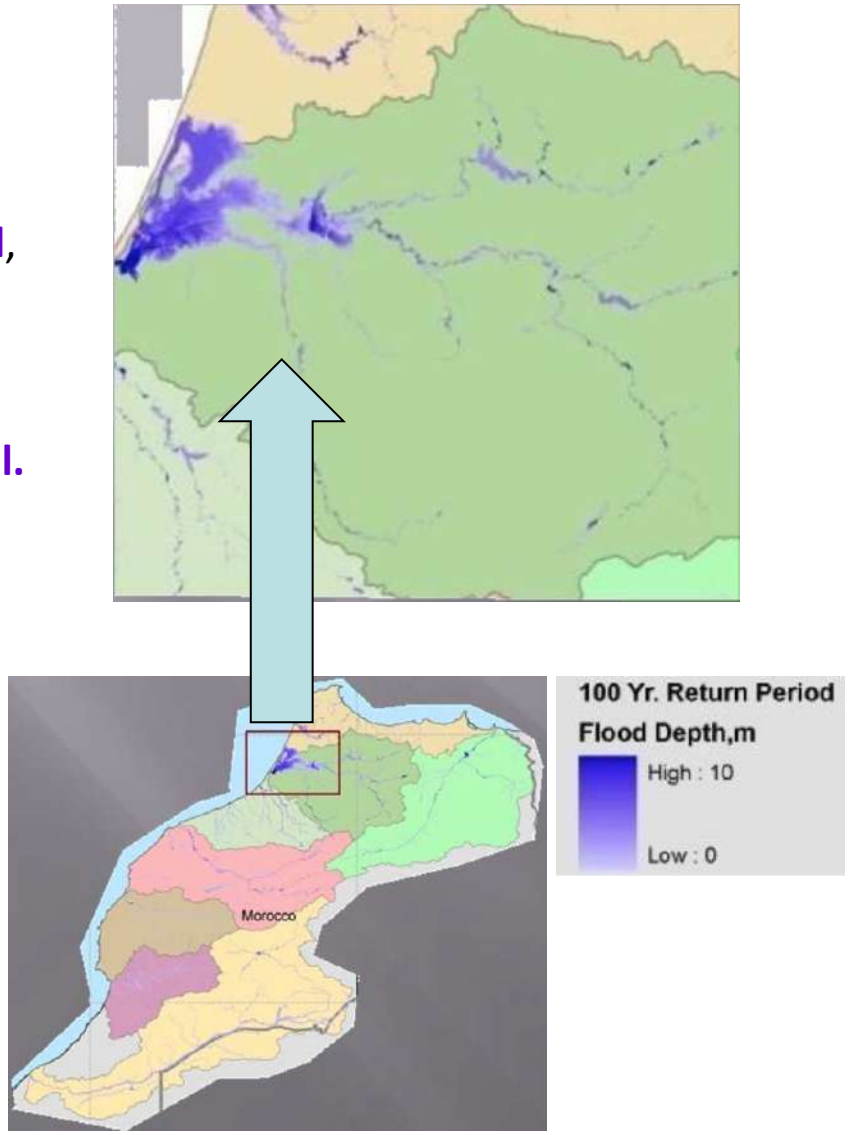
- Souss-Massa : 99
- Moulouya: 62
- Oum Er Rabia: 59
- Sebou: 52
- Tensift: 50
- Loukous: 40
- Ziz-Rheris-Guir: 16
- Bouregreg-Chaouia: 13

Les profils de vulnérabilité ont permis d'établir une segmentation de ces 391 sites par niveaux de risque (très élevé / élevé / moyen / faible), et plus particulièrement d'isoler une cinquantaine de "points noirs" très exposés.



Assurance des risques inondations

- Les pertes annuelles moyennes (AAL) dues aux inondations ont été évaluées à:
  - MAD **1,8 milliards** pour le secteur **résidentiel**,
  - MAD **471 millions** pour le secteur **industriel,**
  - MAD **457millions** pour le secteur **commercial.**
- Les régions qui ont le plus contribué aux pertes annuelles moyennes sont:
  - Gharb-Chrarda-Beni-Hssen,
  - Grand Casablanca et
  - Tanger- Tétouan



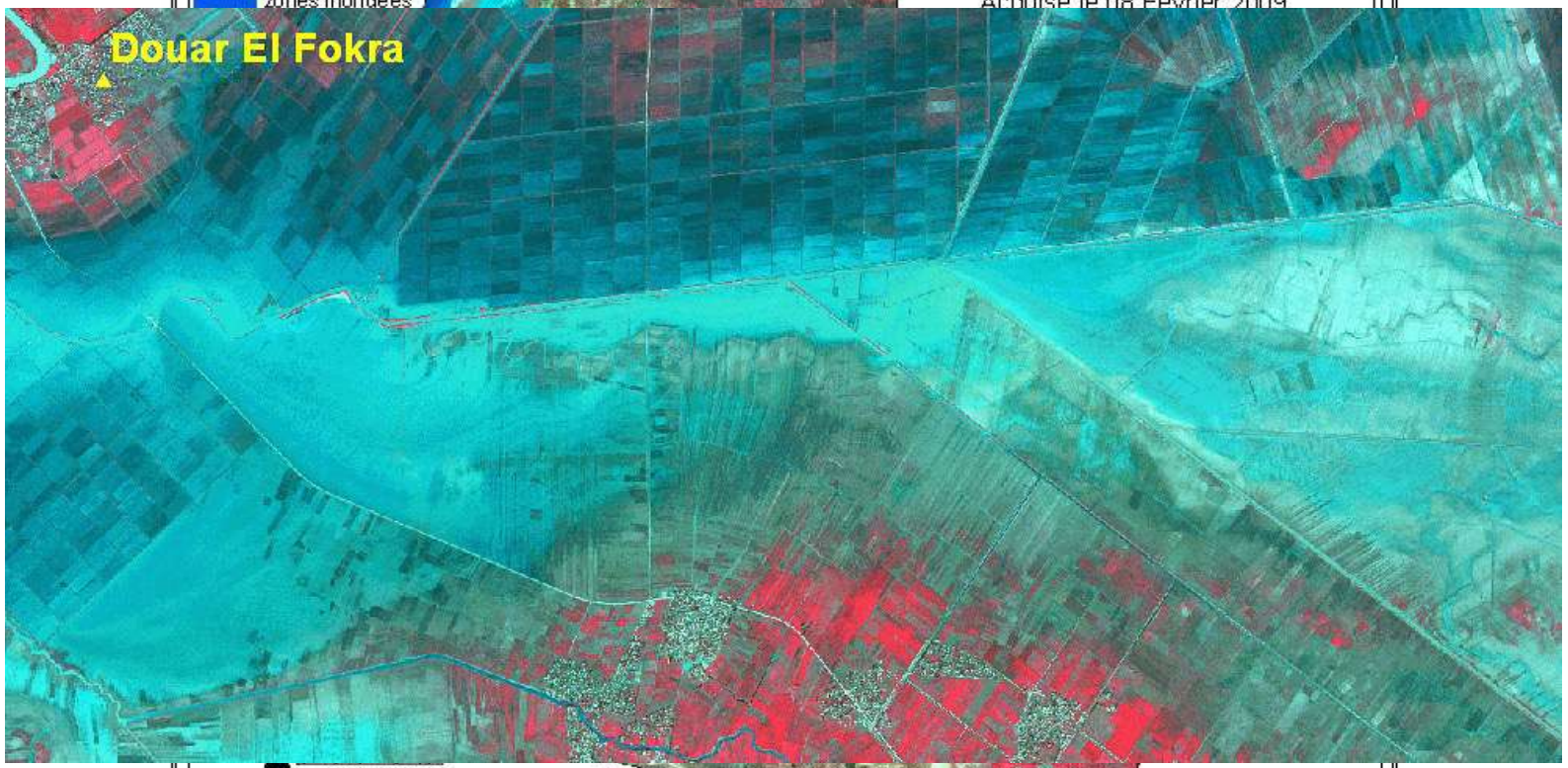
***Source** : Groupe Banque mondiale (2013). Renforcement de la résilience du Maroc : apports pour une stratégie de gestion intégrée des risques.*

Assurance des risques inondations

Cartographie rapide des inondations

Exemple: Douar El Fokra

Image Optique



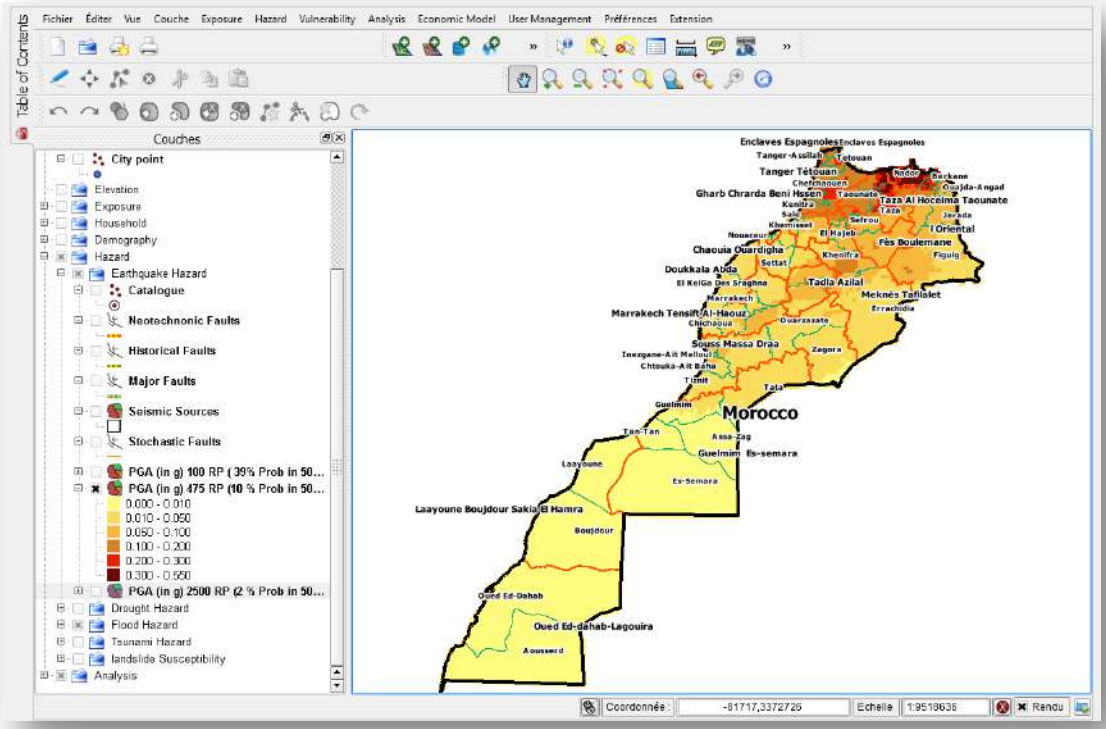
Source: *Centre Royal de Télédétection Spatiale (**CRTS**)*

Assurance des risques inondations

- La modélisation du risque estime les pertes potentielles, par **croisement** des données concernant **l'exposition** (les actifs évalués) et **les aléas** qui les menacent.

- Afin **d'automatiser** la majorité des **calculs** nécessaires, il a été développé un logiciel libre et gratuit appelé **MnhPRA** (Évaluation Probabiliste du Risque d'Aléas naturels pour le Maroc), qui utilise le Système d'Information Géographique (**SIG**).

Interface de l'outil MnhPRA développé pour le compte du gouvernement marocain

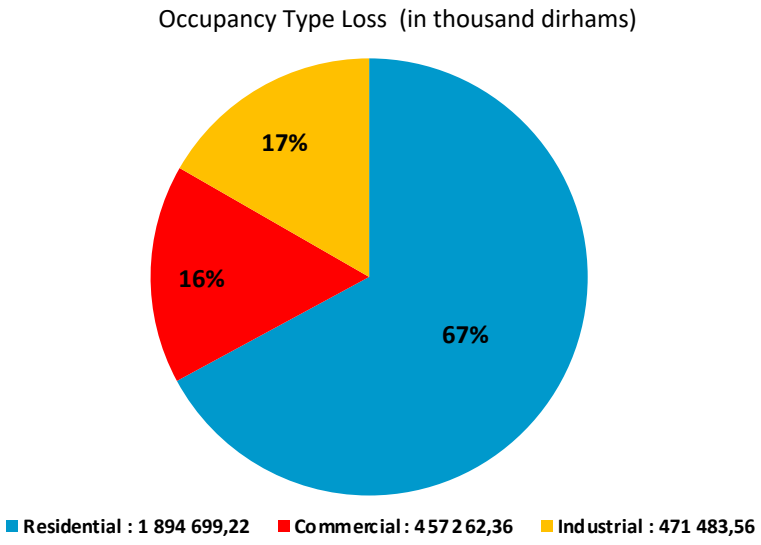


MnhPRA: Morocco natural hazards Probabilistic Risk Analysis

Assurance des risques inondations

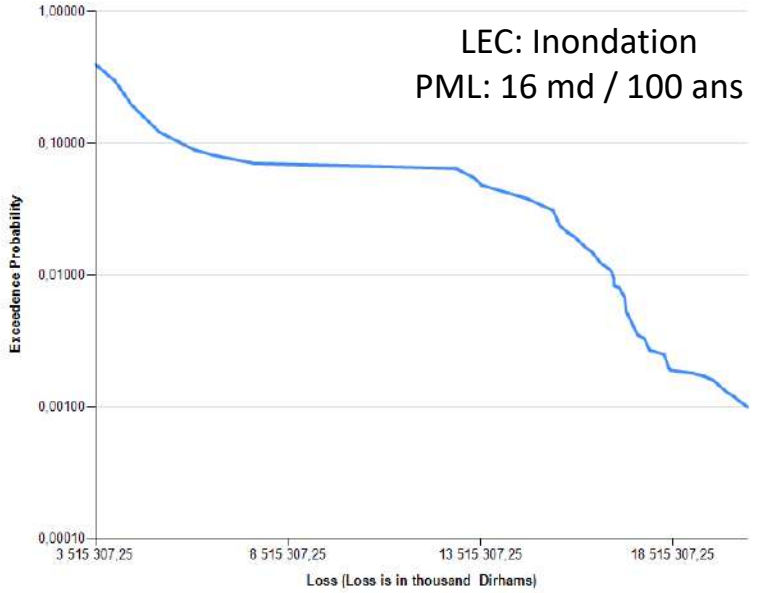
Rapport sur les pertes par MnhPRA:

Inondation: AAL par type d'exposition économique



Exposition par type de Risque

Type d'exposition économique concerné: **Résidentiel, Commercial, Industriel**



LEC courbes (Pertes versus probabilités de dépassement) : Losss-Excedence Curves

MnhPRA peut analyser l'exposition complète du Maroc à **tous les aléas possibles**, ou pour une combinaison de régions, provinces ou communes pour quelque aléa particulier.

Pour chaque analyse, le logiciel produit un rapport sur les pertes qui fournit des données tabulaires précises, des cartes et des graphiques, ainsi qu'une **Courbe de Dépassement des Pertes** (Loss Exceedance Curve: **LEC**).