Industry Adaptation x

AXA Climate

Tackling climate change challenges

Is your Company climate-proof?

- **What will be the impact of climate change on your sites?**

- **How much will it cost?**

- **Is climate change the weak link in your supply chain?**

- **How can you adapt to a changing climate, while seizing the opportunities of a net zero transition?**

- **And what about natural ecosystems?**

Today no region can be considered as "Not at risk" from climate change. Geography doesn't matter any more

Companies cannot assume based on past event, that few regions will not be affected

Did you ever imagine Germany and Belgium

➢ Could get flooded?

➢ For over a month??

➢ 9 times severe than the country's maximum forecasted amount???

"Even developed countries are not safe from severe impacts of extreme weather that we have seen and known to get worse with climate change"
- Friederike Otto, Associate director, University of Oxford's Environmental Change Institute

Germany (July 2021)

➢ 93 mm (3.6 inches) of rain in 24 h

➢ 184 fatalities reported

➢ 1 in 1000-year return period

Belgium (July 2021)

➢ 106 mm (4.1 inches) of rain in 48h

➢ 42 fatalities reported

➢ 1 in 1000-year return period

€11 Bn
Insured losses

Our clients

They trust us – join them!

Manufacturing	Finance & insurance	Infrastructure	Healthcare	Services

MICHELIN

ARDIAN

RENAULT

ST life.augmented

SAINT-GOBAIN

Valeo

First Sentier Investors

Meridiam for people and the planet

GROUPE Casino

AXA MILLÉSIMES

THE WORLD BANK

International Container Terminal Services, Inc.

UNIBAIL-RODAMCO-WESTFIELD

ADITYA BIRLA GROUP

SUEZ

GLOBAL CENTER ON ADAPTATION

African Risk Capacity Sovereign Disaster Risk Solutions & Specialized Agency of the African Union

Bonduelle

Limagrain de la terre à la vie

IPSEN Innovation for patient care

Groupe **Pierre & Vacances CenterParcs**

KLEPIERRE

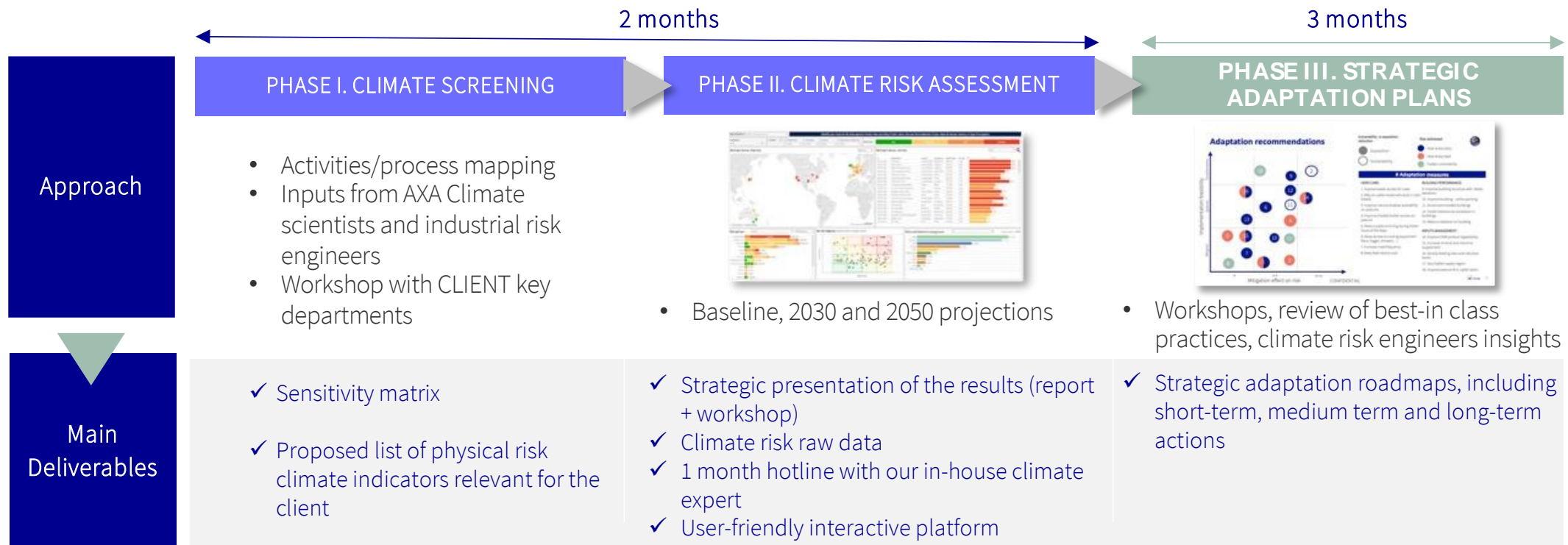**ALSTOM**

...and many more

01

Climate Risk Screening

Understand exposure to physical climate risks on portfolio and assets

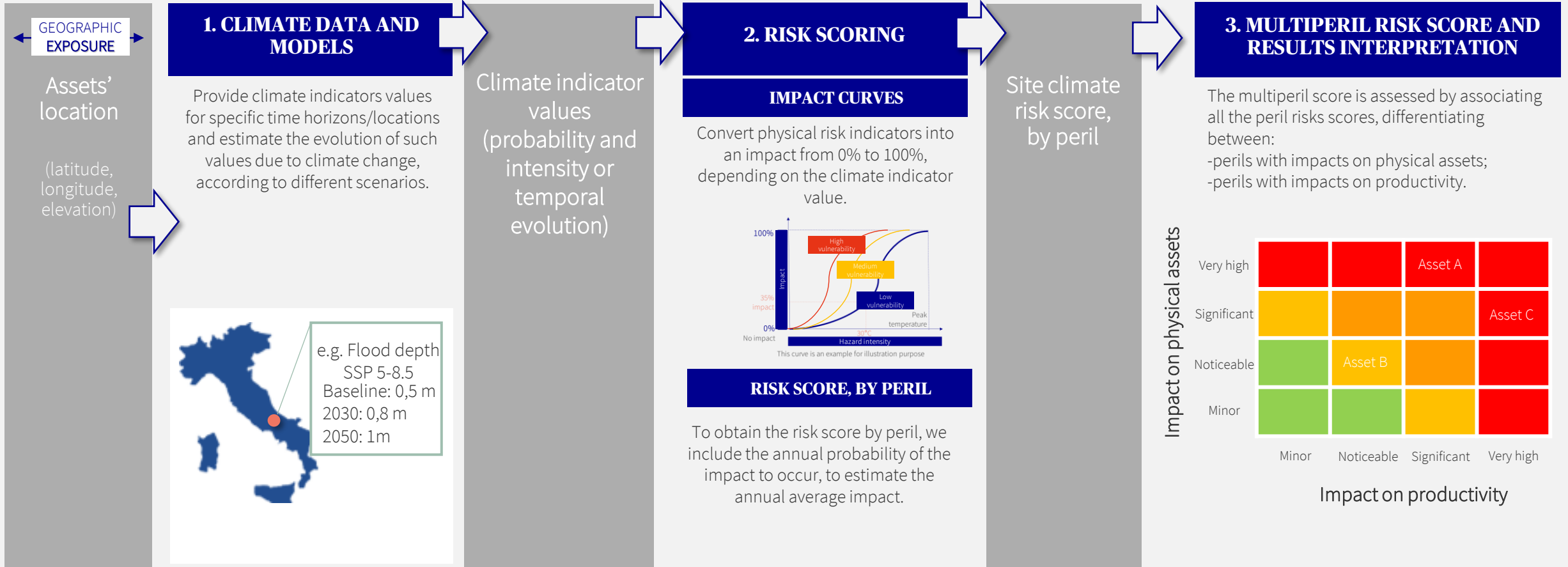# A robust methodology based on science to improve businesses resilience to climate change

2 months | 3 months

	PHASE I. CLIMATE SCREENING	PHASE II. CLIMATE RISK ASSESSMENT	PHASE III. STRATEGIC ADAPTATION PLANS
Approach	• Activities/process mapping • Inputs from AXA Climate scientists and industrial risk engineers • Workshop with CLIENT key departments	 • Baseline, 2030 and 2050 projections	 • Workshops, review of best-in class practices, climate risk engineers insights
Main Deliverables	✓ Sensitivity matrix ✓ Proposed list of physical risk climate indicators relevant for the client	✓ Strategic presentation of the results (report + workshop) ✓ Climate risk raw data ✓ 1 month hotline with our in-house climate expert ✓ User-friendly interactive platform	✓ Strategic adaptation roadmaps, including short-term, medium term and long-term actions

Our methodology for an initial screening of Physical Climate Risks screening

Assets' location

(latitude, longitude, elevation)

e.g. Flood depth
SSP 5-8.5
Baseline: 0,5 m
2030: 0,8 m
2050: 1m

1. CLIMATE DATA AND MODELS

Provide climate indicators values for specific time horizons/locations and estimate the evolution of such values due to climate change, according to different scenarios.

Climate indicator values (probability and intensity or temporal evolution)

2. RISK SCORING

IMPACT CURVES

Convert physical risk indicators into an impact from 0% to 100%, depending on the climate indicator value.

100% — High vulnerability
Medium vulnerability
Low vulnerability
35% impact
0%
No impact — Hazard intensity — Peak temperature — 30°C

This curve is an example for illustration purpose

RISK SCORE, BY PERIL

To obtain the risk score by peril, we include the annual probability of the impact to occur, to estimate the annual average impact.

Site climate risk score, by peril

3. MULTIPERIL RISK SCORE AND RESULTS INTERPRETATION

The multiperil score is assessed by associating all the peril risks scores, differentiating between:
- perils with impacts on physical assets;
- perils with impacts on productivity.

Impact on physical assets

	Minor	Noticeable	Significant	Very high
Very high			Asset A	
Significant				Asset C
Noticeable		Asset B		
Minor				

Impact on productivity

We allow you to go a step further in understanding your exposure to physical climate risks and how they can impact your business

Annual expected loss (AEL) by peril

AEL ($) calculated for a given asset and peril. Computed from the level of hazard and the annual probability of occurrence.
Available for:

- Tropical Cyclones
- Earthquakes
- Flood (Coastal, riverine and surface)

Refining your assets exposure

1. Landslide
Local study of the landslide exposure of an asset to confirm the level of risk, taking into account complementary risk factors.
Identification of potential impacts on surroundings infrastructures and measures to implement to decrease the vulnerability of the asset.

2. Water scarcity
Modelling of water resources management in the area of the asset to anticipate potential impacts.

3. Wildfire
Computation of the current and future exposure of an asset to the wildfire risk based on its surroundings. Computation of the expected economic losses in forested areas.
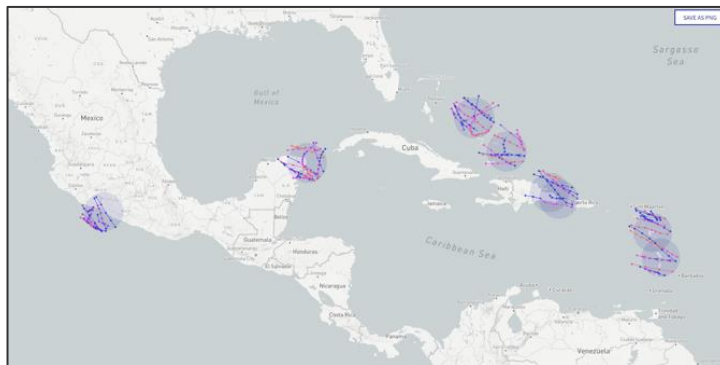
Historical tropical cyclone tracks (1980-2020) within 150km radius from each identified assets (categories on the Saffir-Simpson scale).
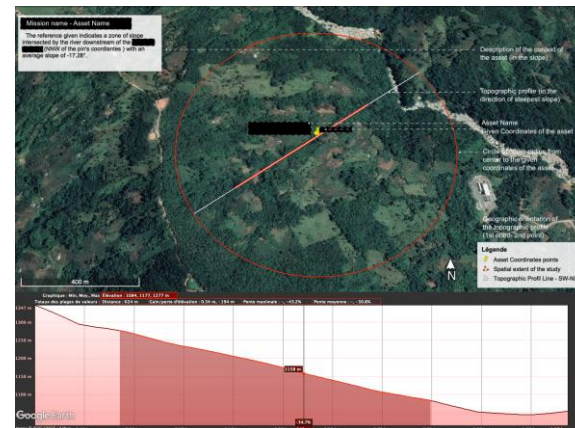
Local study of a landslide asset exposure

xx: Major perils

Riverine Flood can impact 100% of the site's surface area with the lowest probability event (20-year return period). Heat Index is also impacting the asset location with increasing physical value, reflecting soaring impact of heat on working condition and processes

Riverine Flood

Return Period (year)	20	50	100	200	500	1500
Flooded surface (%)	100.0	100.0	100.0	100.0	100.0	100.0
Max flood depth (m)	3.19	3.33	3.4	3.48	3.56	3.67

Water Depth (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0
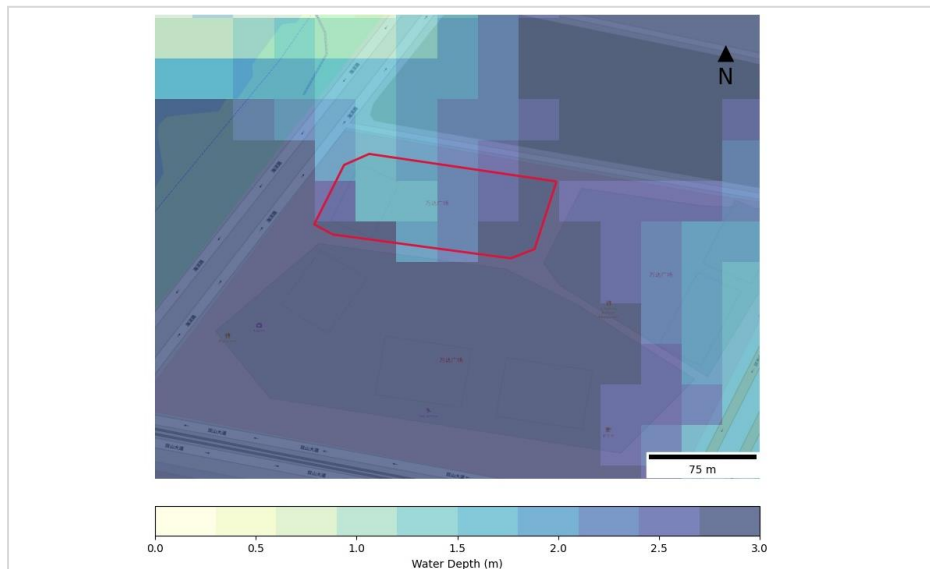
Figure.1 Flooded surface and maximum flood depth of all available return periods at asset location
Figure 2. Flood map of asset location at Riverine Flood (20-year return period event)

The site is exposed to Riverine Flood, with a possibility of **100% of the site surface** flooded (20-year return period event), and **maximum flood depth of 3.7m** (1500-year return period event)

Heat Index

Heat Index (# of days per category)

Y = average number of days per year where heat index is greater than X
(Heat index is an index that combines air temperature and relative humidity.)

- Very dangerous
- Dangerous
- Very uncomfortable
- Uncomfortable
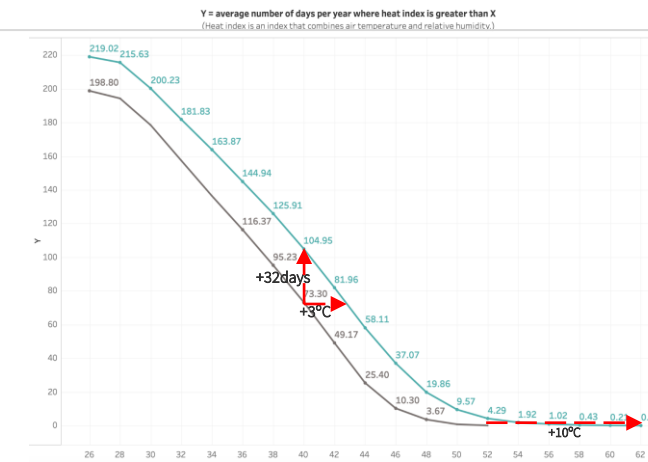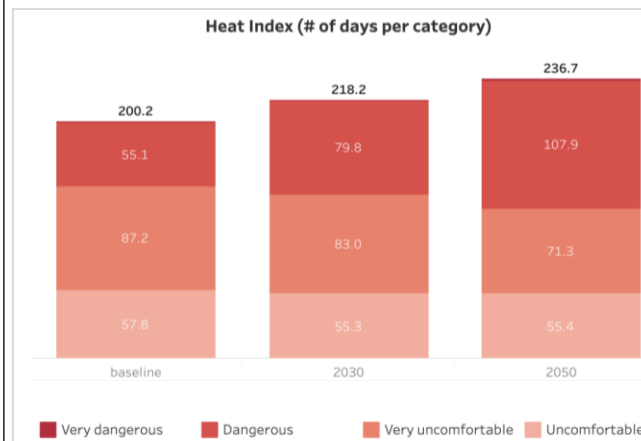
Figure.1 Composition of Heat Index in Baseline and Future timeframes
Figure.2 Frequency distribution of Heat Index higher than 26°C in Baseline and 2030

- **Increase in Frequency**: Under SSP5-8.5, the Number of Dangerous Days increases from 55 days/year by Baseline to 80 days/year by 2030 and 108 days/year by 2050 (figure 1). A similar increase can be spotted in figure 2, as number of days with perceived temperature at 40°C increases from 73 days/year by Baseline to 105 days/year by 2030

- **Increase in Severity**: Under SSP5-8.5 scenario, the line chart on the right also shows an increase in severity of high perceived temperature. For the same frequency of 73 days/year, corresponding Heat Index figure increases from 40°C by Baseline to 43°C by 2030

- **Increase in Severity (Tmax)**: For daily maximum perceived temperature (Tmax), the Tmax by Baseline is 52°C (0.17 days/year) under SSP5-8.5 scenario, while the Tmax by 2030 is 56°C (0.08 days/year)

First of all: what we need from you

The data we need for the scope of the analysis is limited to the following:

Site names

Asset geocodes (or site address)

Primary use / Asset type (platform, warehouse, other…)

Additional information requests

- Additional information on exposure can enable us to refine our risk analysis

For each site, we calculate climate risks exposure based on projected climate change scenarios

- 💧 **Water stress**
- 🌡️ **Mean temperature**
- 🎚️ **Heavy precipitation days**
- 🏷️ **Heatwaves / Coldwaves**
- ☁️ **Extreme heat / extreme cold**
- ❄️ **Heating degree days / cooling days**
- 🌊 **Coastal / Riverine/Pluvial floods**
- 💨 **Tropical cyclones / Winter storms**
- 🔥 **Wildfire**
- 📊 **Landslide, earthquakes**

Output:
Global view of your future risk exposure, and prioritization of assets to more carefully look at.

02

Case studies

Examples of projects and references

Confidential Client –
Renewable portfolio Climate Risk Screening

Objective: A large global infrastructure investor mandated AXA Climate to screen 45+ of its renewable energy assets under management (PV, Wind, Hydro, transmission lines). The objective of this analysis is first to highlight key climate risks for each asset, and second to increase awareness on climate change impact on portfolio.

Methodology: For each asset, AXA Climate has (i) computed climate indicators in baseline, 2020, 2030 (short-term) and 2050 (mid-term) under 2 global warming scenarios (SSP2-4.5 and SSP5-8.5), (ii) spotted predominant or strongly aggravating risks along with climate change, and (iii) suggested next steps for the asset manager to undertake (e.g., conduct additional investigations, check risk mitigation plan, include projections into business model…).

Key results: We have identified the assets facing high risks aggravating with climate change and requiring a high level of attention from the asset manager.

"I was really happy with the data. It is easy to interpret, and not a black box. I can understand it where you go with it. I appreciated how you follow up to make sure we were happy with the product."

"It really helps us with our TCFD-aligned reporting."

Confidential Client –
Design a tailored methodology for climate physical risk integration

Objective: An investor in Renewable Energy infrastructures mandated AXA Climate to develop a methodology to integrate climate physical risk data modelling into their processes, to make their assets (offshore wind, onshore wind, solar PV, and energy storage) more competitive and more robust/resilient.

Methodology: AXA Climate has (i) conducted interviews with investment team members to precisely identify how climate data could add value at each stage of the investment process, (ii) developed a tailored methodology to integrate climate physical risk analysis at each stage of the process, in a time and cost-efficient way, (iii) tested the approach on four assets, by sending to the team relevant climate data and analyses.

Key results: Climate data have revealed non negligible changes in producible in the medium to long term. The team has updated the company's risk matrix to integrate climate physical risks.

"Thank you for this constructive collaboration. The analysis is state-of-the art and very helpful."

"This project has helped us increasing our knowledge on climate risks. We understand the risks and know how to take them into account."

Confidential Client – French international utilities group

Objective: A major utility group has hired AXA Climate to screen physical risk over several units across the world and to pre-identify climate adaptation measures for the most at-risk sites.

Methodology: AXA Climate has (i) conducted a Climate Risk Screening on several units in 3 different continents, either drinking water production units, waste-to-energy plants, or waste-water treatment units, in 2030 and 2050 under 2 global warming scenarios SSP2-4.5 and SSP 5-8.5, (ii) prioritize the most at-risk sites, and (iii) listed preliminary adaptation measures.

Key results:
Heat, drought, and rain can cause major failure to biological process of treatment, leading to deterioration of equipment and structure due to an excess of H_2S production (highly corrosive gas) and discharge of polluted water with impact on biodiversity and marine ecosystem

"What is interesting in your approach is that you provide not only accurate data for climate physical risks, but you also consider the 'so what' with specific implications derived from your physical vulnerability assessment."

Confidential Client – International electronics component manufacturer

Objective: A major industrial player needed to update its Climate Resilience program with accurate climate risk data, with several internal objectives (Business Interruption Risk Assessment, Business Impact Analysis, Manufacturing Supply Chain Strategy, Extra Financial Disclosures). The client mandated AXA Climate to conduct a Climate Risk Screening of its activity.

Methodology: AXA Climate conducted a Climate Risk Screening of the group's 50 assets and 88 strategic subcontractors to highlight and quantify key risks related to climate with both acute and chronic impacts, in 2030 and in 2050 versus current climate conditions. We shared all data in a fully transparent manner and organized a specific scientific workshop about the impact of climate change on medicanes (Mediterranean hurricanes which impacted one of their site in Southern Europe).

Key results: 11 strategic suppliers were found to be very vulnerable to climate risks. Specifically, one site in South-East Asia has been identified to be at risks of increasing typhoon paths.

"Thanks to this mission, we have realized that our supply chain was more vulnerable to climate change than we expected, and we have updated our supply chain strategy accordingly. Well done!"

Bonduelle -
Assess peas production climatic vulnerability in North of France

Objective: Bonduelle and OPL Vert mandated AXA Climate to screen 23 of its production areas in north of France, Morbihan and Landes for climatic risk. The objective of this analysis is first to highlight key climate risks for each region, and second to assess specific peas vulnerability – with 18 specific vulnerability indicators - to these climatic risks.

Methodology: For each region, AXA Climate has (i) computed climate indicators in baseline, 2020, 2030 (short-term) and 2050 (mid-term) under 2 global warming scenarios (RCP4.5 and RCP8.5), (ii) spotted predominant or strongly aggravating risks along with climate change, and (iii) build a ExcelVBA tool for the client to be able after proper teaching to modulate any risk threshold on its production.

Key results: The main risk faced by cultures is heatwave. Most of the areas will face heatwaves risk, with potential strong damage on Bonduelle's productivity.

"Very qualitative work that drives awareness internally."

"This study has opened our eyes to the probable evolution of the problems around our pea production."

"The analyses were detailed, the way of working was fluid, you were able to listen and react."

Transportation industry
Nat Cat Analysis and physical climate risks on assets

Objective: CLIENT mandated AXA XL Risk Consulting and AXA Climate to conduct a Nat Cat Analysis and to assess its physical climate risks on 933 assets in 66 countries. The portfolio covered industrial sites, warehouses, data centers.

Methodology: For each asset, AXA Climate has (i) assessed the exposure to 12 Nat Cat perils, computing a peril score to identify top priority sites and countries (ii) quantified physical climate risks (acute and chronic) with scenario analysis (iii) conducted a deep-dive analysis of 4 countries: US, Canada, China, India, (iv) provided climate adaptation consideration.

Key findings: In current climate conditions, CLIENT exposure to Nat Cat can be ranked as moderate. Flood is the most important peril, potentially generating large yearly loss accumulation. Present acute risks are confirmed and will be reinforced in the future. Top-priority countries for Nat Cat are France, Germany, US.
Considering chronic risks and future times, the countries at risk become: US, Canada, China and India. Almost all Chinese and Indian sites are at extreme risk, but their financial value is irrelevant. In the US, one extreme risk site is close to 3 high risk sites, all of low financial value but constituting a strategic manufacturing hub where investments are planned. The 4 sites being interdependent, there is a significant accumulation risk due to flood.

"The study is aligned with our goal to have more precise climate risk data. The results are exciting yet disturbing." – Group Real Estate director

The World Bank –
Design a drought cover for DRC farmers

Objective: The World Bank is launching a 5-year, $500 million agriculture modernization project in the Democratic Republic of Congo (DRC). More than 1.7 million farmers are expected to benefit from the program. The World Bank mandated AXA Climate to assess what is the best way to protect DRC farmers in a value-for-money perspective. Several options have been explored, among which a parametric insurance scheme and a national reserve fund.

Methodology: AXA Climate has (i) carried out a cost-benefit analysis of different protection systems for farmers growing maize and cassava; (ii) researched and synthesized operational recommendations for program implementation; and (iii) initiated discussions with the relevant players (regulators, local insurers, etc.) in order for the project to be implemented with an appropriate level of support.

Key results: The World Bank will leverage our study to protect 1,7M farmers in DRC against drought. AXA Climate will likely engage some capacity in the deal to come (most likely in early 2023).

"I was extremely satisfied of the quality of the work and the respect of deadlines. The working sessions organized at AXA Climate have been very useful to deep dive into the project's challenges."

Présentation de l'offre de conseil AXA Climate

Modéliser le changement climatique pour prévoir les impacts

Mars 2023
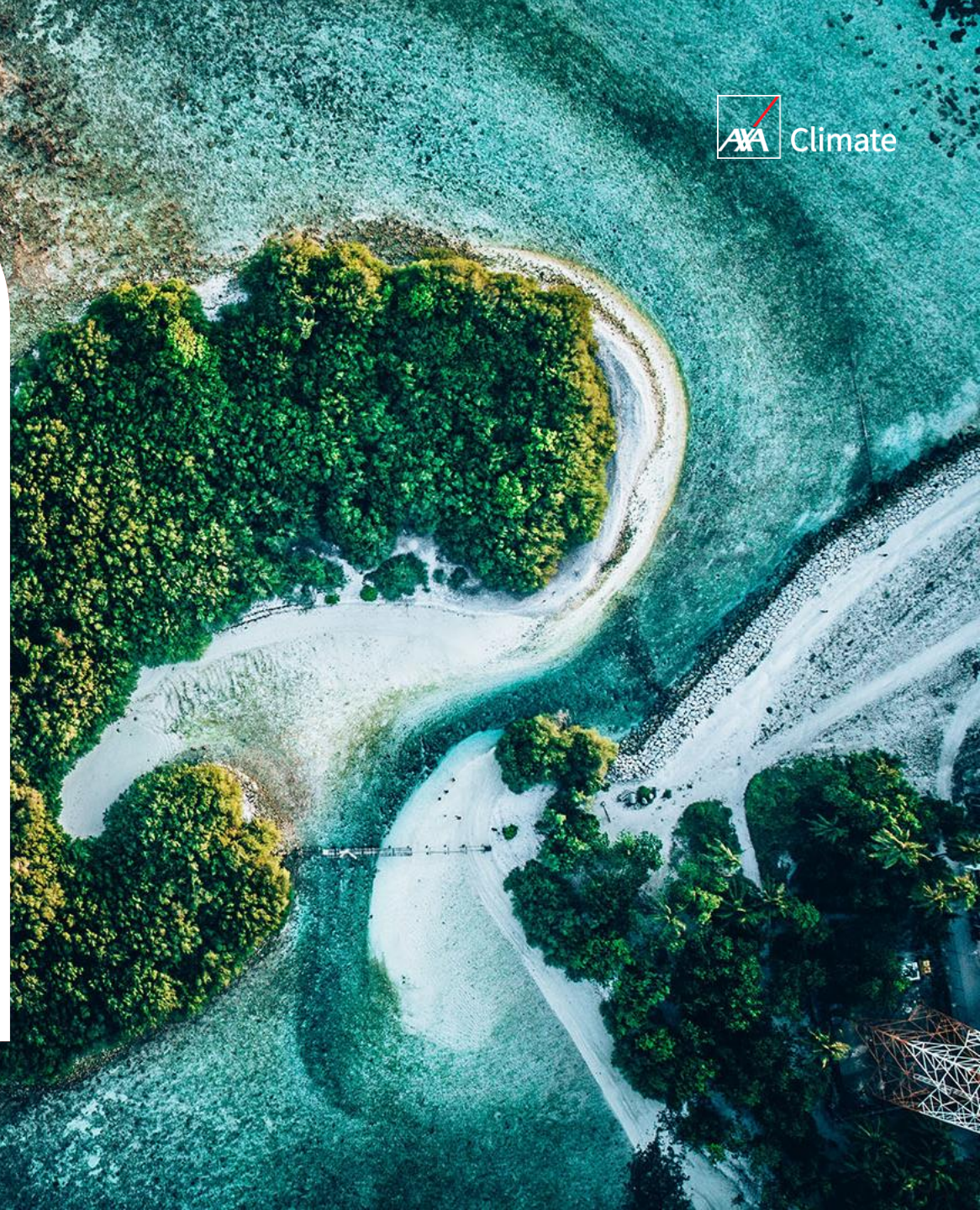
Notre spécificité : une combinaison d'expertise scientifique et pédagogique intégrée, de modélisation climatique et de conseil stratégique

La science est notre socle

30+ scientifiques, climatologues et agronomes en interne

Une hotline scientifique
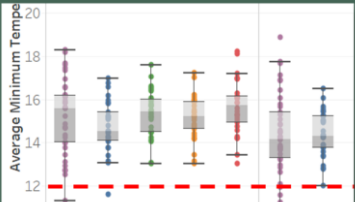
L'apprentissage pour engager & responsabiliser

Pas de "boîte noire"

Expertise pédagogique

Une approche de   co-construction

La tech et la data pour modéliser

Outils de modélisation propriétaire des risques climatiques

Un catalogue de 130 indicateurs climatiques, utilisés en assurance

L'expertise d'AXA en terme d'impact financier

100 ans d'expertise d'AXA en matière d'impacts financiers

Recommandations stratégiques robustes & éprouvées

2022 est une année record

Au total, les événements naturels pourraient occasionner une charge de 10 Md€ aux compagnies d'assurances...

...auquel il faut ajouter entre 2 et 2,9 Md€ de sinistres liés à la sécheresse (retrait gonflement des argiles)

2022	Précédents records
Grêlons de **12 cm** lors des épisodes de grêle du 22-23 mai et du 18-27 juin	Grêlons de **12 cm** de diamètre, dans le Nord, le 25 mai 2009
250 mm de précipitations en moins de 2h à Nîmes à l'origine d'inondations du 05 au 08 septembre	**182 mm** en 2h dans le Gard, le 19 septembre 2020
Rafales jusqu'à **220 km/h** lors de la tempête en Corse, du 17 au 19 août	**225 km/h** en Corse, en 2018
206 km parcourus par la Tornade EF3 de Bihucourt, le 23 octobre	**81,1 km** parcourus par la Tornade EF4 de Saint-Claude, le 19 août 1890
13 800 ha brûlés lors du feu de forêt de Landiras du 12 au 25 juillet 2022	**11 580 ha** brûlés lors du feu de forêt de Vidauban, en septembre 1990
Coût estimé entre **2,0** et **2,9 Md€** lors de la sécheresse.	Coût de **2,1 Md€** lors de la sécheresse estivale de 2003.

Les risques sont multiples sur l'ensemble de votre chaine de valeur

Sourcing → **Production** → **Transport/ Logistique** → **Distribution**
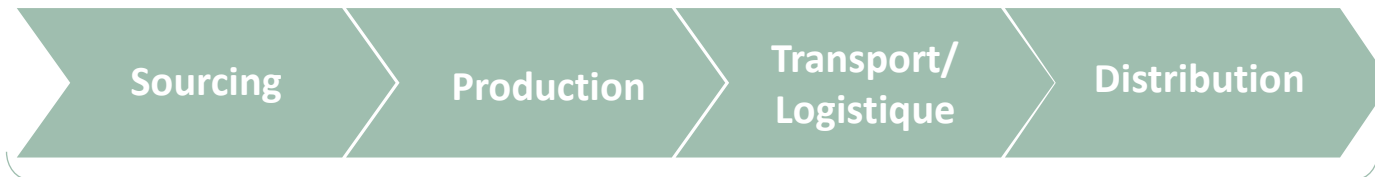
Risques physiques

- Climat
- Stress hydrique
- Valeurs des biens
- Ressources
- Espèces
- Pollution

…

Risques de transition

- Réglementations
- Réputation
- Technologie
- Marchés

…

Impacts financiers

Chiffre d'affaire (évolution de la demande)

Fluctuation des prix (matières premières)

Perturbation de la supply chain

Assurance & autre coûts

Dommages physiques

Intérêt des investisseurs

…

L'adaptation est aussi importante que l'atténuation !

Et souvent, les solutions qui en découlent permettent de répondre aux deux objectifs

03

⌄

Quels leviers pour se préparer & s'adapter ?

Une méthode autour de 5 leviers pour assurer l'adaptation de vos activités face au changement climatique

Périmètre global & projections 2030/2050

1 **Evaluer les risques et opportunités climatiques sur l'ensemble des activités pour prioriser des mesures d'adaptation**

4 **Le cas échéant, recourir à des outils de financement & d'assurance paramétrique sécurisantes**

Visite de sites & projections 2030/2050

2 **Quantifier les vulnérabilités spécifiques sur les actifs les plus stratégiques & évaluer les impacts**

Spécificités locales, à l'échelle des territoires & plans d'action annuels

3 **Identifier les solutions d'adaptation & mettre en oeuvre les plans d'action stratégiques associés**

5 **Engager les équipes internes à mieux comprendre le changement climatique et donner les clés pour agir pour la transition grâce à notre "Climate School"**

Objectif

Evaluer les **impacts globaux du changement climatique sur vos activités** en évaluant les risques de chaque site

Méthode

- **MODELISER** les risques et les opportunités climatiques à 2030/2050 sur vos actifs.

- **ETENDRE** la modélisation si nécessaire à vos sites de fournisseurs

- **PRIORISER** les actifs et territoires les plus à risque

Conforme CSRD

Cartographier les principaux risques climatiques sur l'ensemble des sites à horizon 2030/2050

Objectif

Quantifier les **vulnérabilités spécifiques de vos activités** & identifier les solutions locales d'adaptation

Méthode

- **SELECTIONNER** les indicateurs & seuils de vulnérabilité en fonction des activités visées

- **MODELISER** les vulnérabilités spécifiques & **MESURER** les impacts sur la résilience.

- **CONSTRUIRE** les plans d'action stratégiques d'adaptation

Most impacted assets by water stress

DATA CENTERS

Evaluer la vulnérabilité des sites au stress hydrique

AGRO-INDUSTRIEL FRANÇAIS

Evaluer la vulnérabilité climatique de la production de pois dans le Nord de la France

Objectif

Considérer les risques de manière systémique en testant des scénarios d'adaptation afin de prendre des décisions.

Méthode

- IDENTIFICATION des solutions d'adaptation et évaluation de leur impact
- ÉLABORATION de plans d'adaptation stratégiques
- SIMULATION de différents scénarios
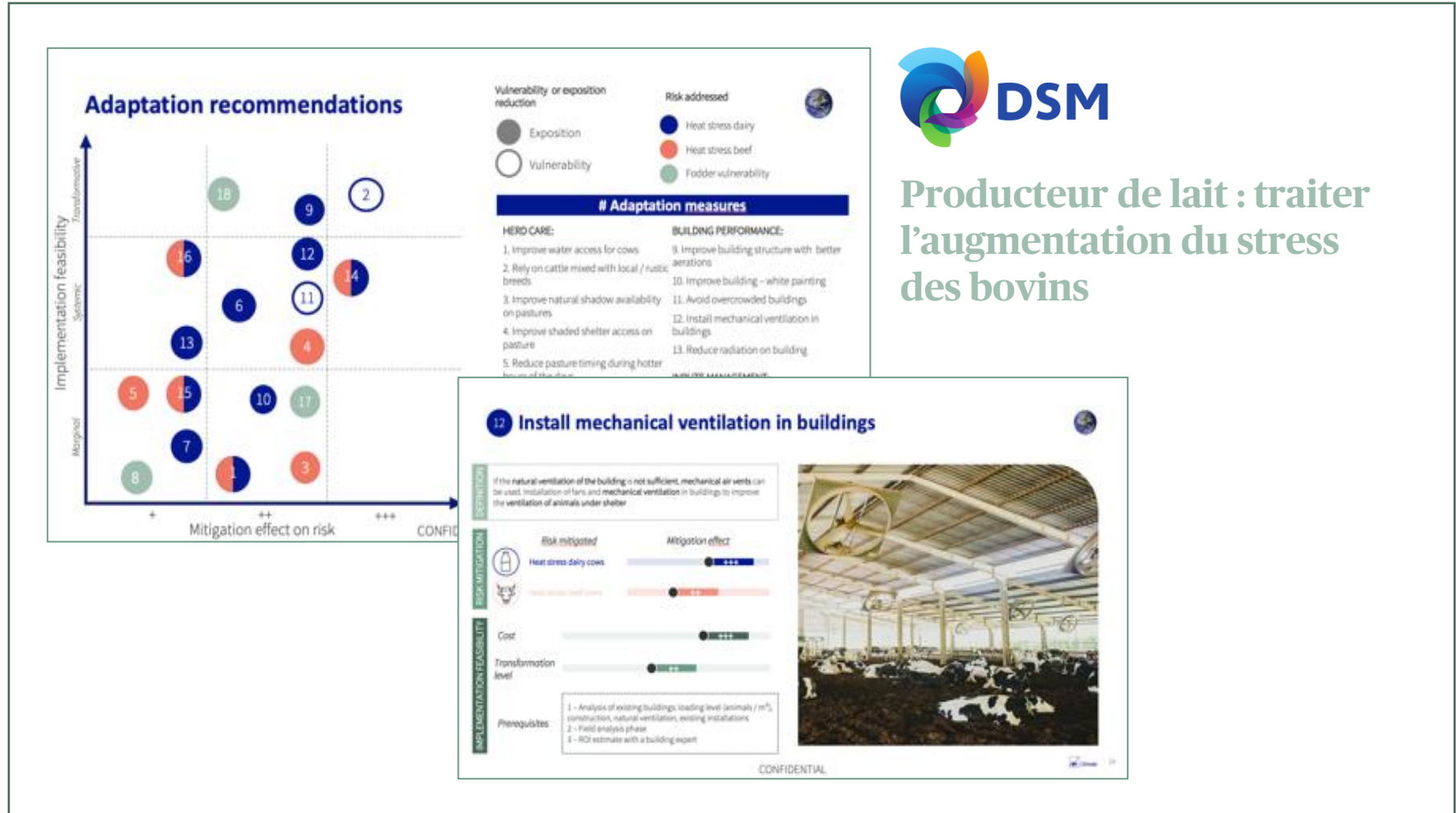
Producteur de lait : traiter l'augmentation du stress des bovins

Apporter des offres d'assurance paramétriques sécurisantes

Objectif

Construire des offres d'assurance qui traitent des périls spécifiques

Méthode

- IDENTIFIER les activités météo-sensibles et leur vulnérabilité

- ASSURER via la mise en place de solutions d'assurance paramétrique calibrées sur des indicateurs climatiques
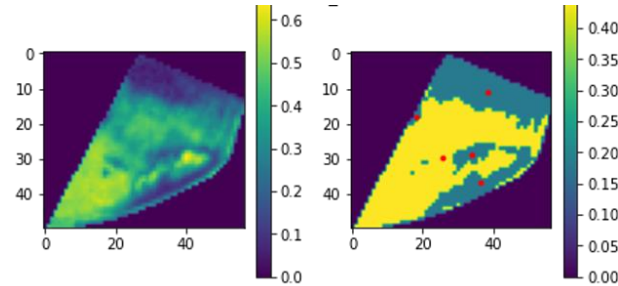
Utilisation de données satellitaires pour couvrir de la sécheresse sur du colza

Utilisation de données satellitaires pour couvrir des feux de forêts

Données d'accélération des sols pour le tremblement de terre

Données de température pour les factures d'énergie
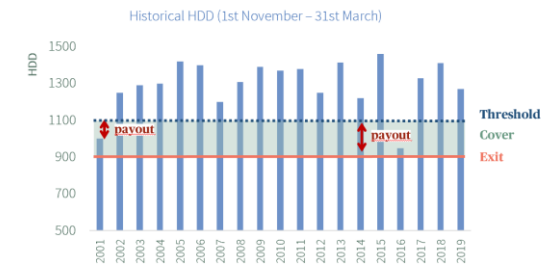
5 Engager les équipes internes à mieux comprendre le changement climatique et donner les clés pour agir pour la transition grâce à notre « École du Climat »
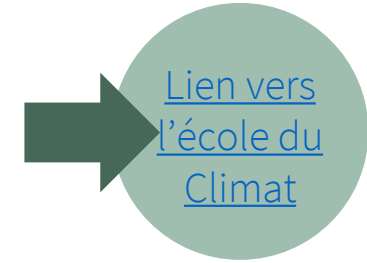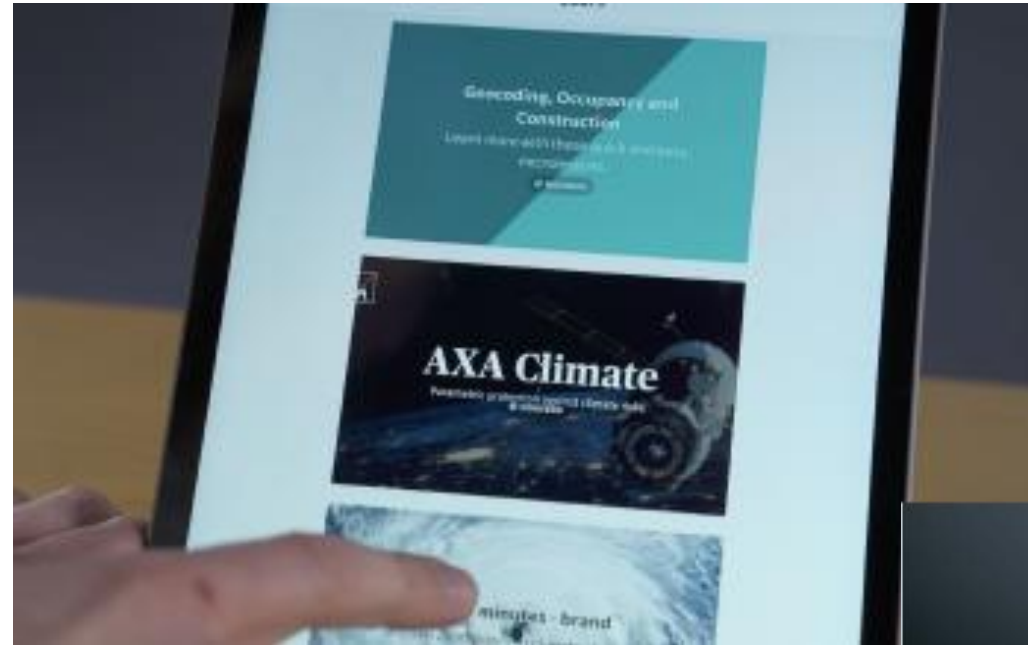
Objectif

Engager et former les collaborateurs sur la transition écologique via une formation digitale & de microlearning.

Méthode

- COMPRENDRE via 6 cours sur le mécanisme intrinsèque et les effets de ricochet entre le changement climatique, les ressources naturelles, la biodiversité et les sociétés humaines.

- AGIR via 4 cours sur les défis collectifs du développement durable et 8 cours métier (IT, achats, juridique, finances, RH, risques, facility management, marketing et communication).

Lien vers l'école du Climat

Vidéo de présentation