A QUESTION OF DEVELOPMENT
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SYNTHESES OF AFD STUDIES AND RESEARCH

Vulnerabilities to climate change in the French overseas territories and small island states

GENERALLY HIGH LEVEL OF VULNERABILITY, WITH VARIABLE EXPOSURE TO THE DIFFERENT RISKS

The Physical Vulnerability to Climate Change Index (PVCCI) measures the vulnerability of small island territories to the impacts of climate change, whether periodic (cyclones, droughts) or progressive (rise in average air temperatures or sea levels). The analysis of these components contributes to informing adaptation policies, which aim to reduce the vulnerability of territories, populations and sectors of activity in the long term.

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The French Overseas Departments and Territories (DCOM) are located in the Indian, Pacific and Atlantic Oceans, as well as in the Caribbean and in South America. They have certain structural characteristics in common with the small island states in their regional environment. These areas are particularly vulnerable to climate change, especially due to the fact that the combination of physical and human characteristics means that the territories, most of which are located in tropical zones, are highly exposed to coastal risks. Concerning the overseas territories more specifically, according to the report by the National Observatory on the Impacts of Climate Change (ONERC, 2012), most of the current risks will remain the same or increase in the future. These changes will exacerbate the pressures which already exist in the DCOM and that are related to development methods that are unsustainable as a result of human pressure (population and urban growth, ways of life). They will undeniably have consequences, firstly on biodiversity (80% of biodiversity in 22% of the national territory) and, secondly, on a number of sectors of activity, especially tourism, fishing and agriculture.

This study is part of a series of research projects that seek to calculate composite indicators for France's overseas economies. Indeed, until very recently, there were few indicators to grasp the socioeconomic reality and vulnerabilities of the overseas territories and compare them to other territories. The composite indicators of the United Nations Development Programme (UNDP), such as the Human Development Index (HDI), or of the UN Committee for Development Policy (Economic Vulnerability Index), calculated for France, were not disaggregated by sub-national territories.

This work involved calculating a composite indicator, the Physical Vulnerability to Climate Change Index (PVCCI), for 83 island territories, including the French overseas ...

territories[1]. By measuring the likely magnitude of shocks and level of exposure to these climate shocks, PVCCI assesses, in a synthetic and comparative way, various aspects of the vulnerability to climate change of the DCOM and small island states (rise in temperatures, desertification, rise in sea levels, increase in the recurrence and intensity of extreme events, etc.).

How is the Physical Vulnerability to Climate Change Index built?

The Physical Vulnerability to Climate Change Index (PVCCI) has been developed in recent years at FERDI (Guillaumont and Simonet, 2011a and 2011b; Guillaumont, 2013)[2]. It is based on components that reflect the main physical consequences of climate change which can potentially affect the welfare and activity of populations, as identified in the literature on the subject. PVCCI is a structural or physical index and aims to assess the vulnerability which does not depend on the socioeconomic characteristics of countries. It leaves out resilience (often included in other indicators), which largely depends on the policies of countries or on their capacity to face shocks, which itself depends on the level of development of territories or countries.

The components of PVCCI look at two types of risks related to climate change:
- Those which correspond to permanent, progressive and irreversible shocks;
- Those which correspond to an intensification of recurrent shocks.

For these two types of risks, the components assess the likely amplitude of shocks and the level of exposure to these shocks.

Recurrent shocks are reflected by the variation in the average value of climate variables (temperatures and rainfall) and by the change in their instability. The vulnerability to future shocks can be measured *ex ante* (forecasting model), when this is possible (particularly for the likely rise in the sea level), or *ex post* (on the basis of past trends, which is done here for temperatures and rainfall).

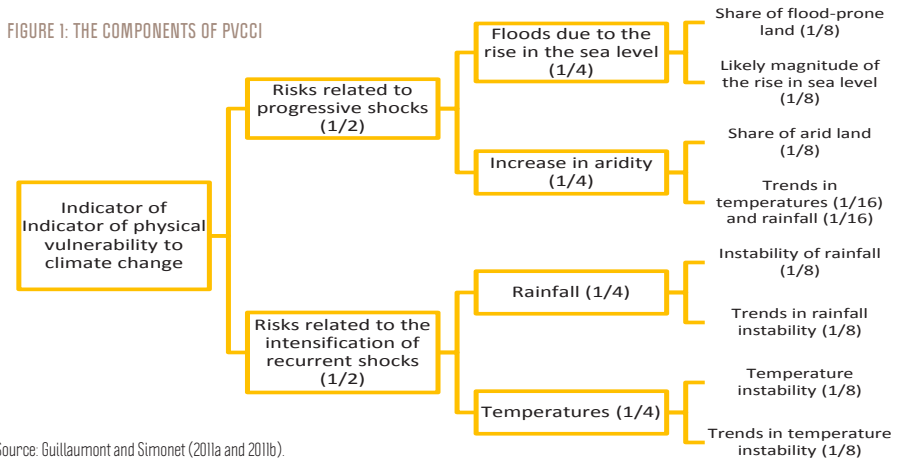
These physical indicators (sea level, rainfall, temperatures) are objective or neutral data (unlike socioeconomic data, which are partly influenced by resilience or political factors). The PVCCI components are subject to a standardization so that they are comparable. The aggregation method reflects a limited substitutability between the components through a root mean square. Consequently, an island with a large part of its territory in flood-prone areas and an arid country suffering from a rising trend in temperature levels will have both a component close to the maximum, and therefore a high PVCCI.

In the overseas territories, a vulnerability comparable to and sometimes higher than on nearby islands

On the face of it, the small island territories show a high level of vulnerability to climate change, but only in terms of certain aspects. Indeed, the rise in temperatures is lower in the oceans than on the continents (or on the large islands, such as Madagascar), and there is little or no risk of exposure to drought in these small territories. However, they are more exposed to the rise in sea levels and intensification of extreme events (rainfall shocks, cyclones).

The aggregation of the PVCCI components shows that the French West Indies are more vulnerable to climate change (particularly Guadeloupe and Saint-Martin), followed by French Guiana, whose PVCCI is higher than in Suriname and French Polynesia, where the PVCCI is higher than the Samoan Islands Tuvalu or Vanuatu (Figure 2).

FIGURE 1: THE COMPONENTS OF PVCCI

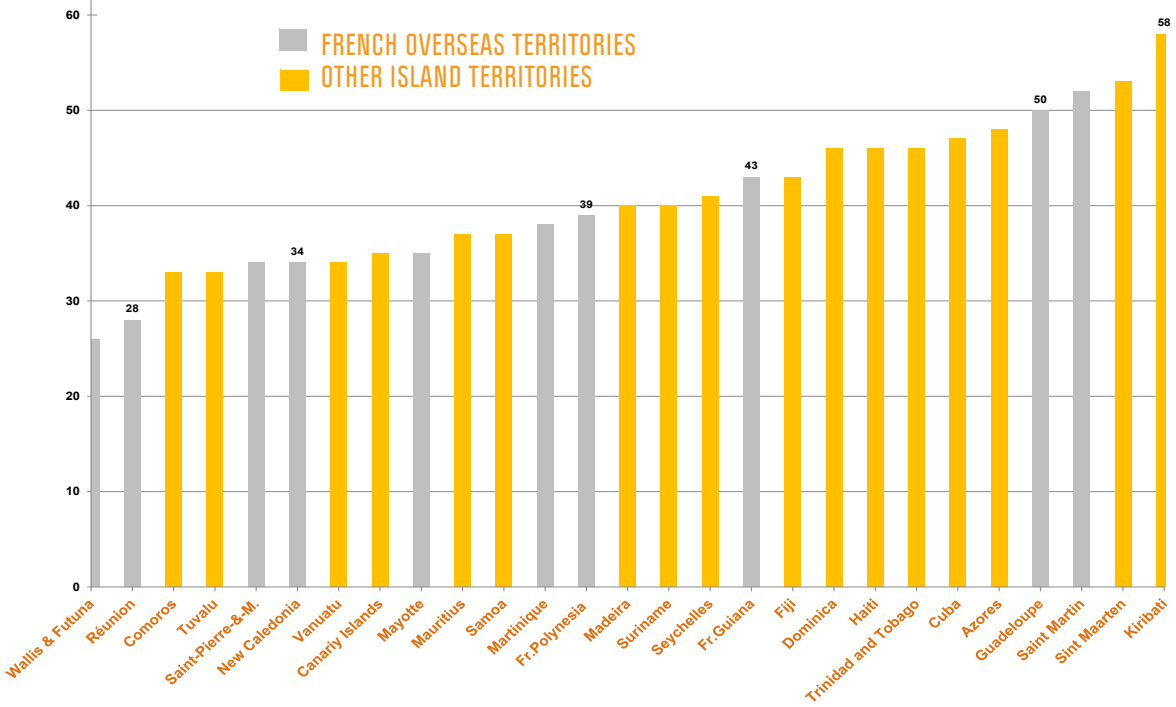


NOTE:
WEIGHT OF THE COMPONENT IN THE INDICATOR GIVEN IN BRACKETS.

Source: Guillaumont and Simonet (2011a and 2011b).

[1] See all the results in the Working Paper entitled "Vulnérabilités comparées des économies ultramarines françaises", WP 145, AFD, 2015.
[2] See http://www.ferdi.fr/indicateurs-innovants.html

FIGURE 2: PHYSICAL VULNERABILITY TO CLIMATE CHANGE INDEX (ROOT MEAN SQUARE)



Source: Authors' calculation.

Variable exposure to the various risks depending on the island territories

An analysis of the disaggregated components highlights the weaknesses of each territory. Climate change adaptation policies need to take these specificities into account.

The sea level has risen from less than 3 mm a year to over 5 mm a year over the past 20 years. Projections for the end of the 21st century range between +40 cm and +60 cm and even stand at +1 m in extreme cases. The risks related to rising sea levels are limited overall in the French overseas territories, but are high in Saint-Martin, French Polynesia, Wallis-&-Futuna and Saint-Pierre-&-Miquelon.

Risks related to drought (or desertification) are naturally low, but certain territories stand out for the significant rise in temperatures (particularly the West Indies, with an increase of at least one degree – 2.2°C in Martinique – over the past 60 years). Almost all the small islands (including the French overseas territories) and small coastal countries have a PVCCI drought component of zero, with the exception of a few territories (such as Aruba, Cape Verde, St. Helena, Cyprus and islands in the Persian Gulf). However, there are substantial risks related to temperature instability (particularly in Guadeloupe).

Rainfall instability is overall the highest risk in the DCOM and other small island territories. The Canary Islands are an extreme case and, along with Madeira, have the lowest average rainfall and a strong downward trend (and the largest fall in relative terms, similar to Vanuatu and Mauritius). This is combined with a relatively strong upward trend for temperature increases. All the territories suffer from significant rainfall shocks. This risk is particularly prevalent in French Guiana, which is also reflected in certain data, such as the number of victims of natural disasters, or the instability of exports and agricultural production. The West Indies, which have been subject to a sharp rise in temperatures, are also among the territories experiencing the most marked increase in rainfall. While Réunion has moderate results in terms of average rainfall and trends (positive), instability is, however, by far the highest there.

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Adaptation policies and development models need to mainstream climate-related risks

Climate change will put pressure on development models and paths in the French overseas territories and small island States. The adaptation policies which need to be implemented to mitigate these vulnerabilities should reduce exposure to the shocks which these territories are subject to, particularly the exposure related to the concentration of agricultural exports, by continuing the effort to diversify agricultural production and the search for niches. They should also reduce the exposure related to the presence of people in low-lying coastal areas, through territorial development policies aiming to protect populations "at-risk" and the activities located in these areas.

Furthermore, efforts must be continued to enhance the forecasting of progressive or recurrent "shocks" related to the different types of risks (droughts, floods related to rising sea levels, temperature increases, frequency of natural disasters, such as cyclones) thanks to increased regional cooperation.

At local level, three main areas must more specifically draw the attention of national and local actors in terms of adapting to the impacts of climate change and mitigating the structural vulnerability of island territories, i.e. natural resources management, sectors of economic activity and risk management.

Natural resources management includes water resources management, as well as conservation of terrestrial and marine biodiversity and conservation of soils. Certain already endangered species are particularly vulnerable to the consequences of climate change, which is an aggravating factor. In the island territories, ecosystems have adapted to changes in the past, but the current changes are occurring, and are likely to occur in the future, at an unprecedented pace (ONERC, 2012).

The main economic sectors concerned are agriculture, forestry activity, fishing, tourism, but also energy, transport and construction. Climate change may have a significant impact on sugar and banana production in the French overseas territories, as it may cause a shift in the altitude of the associated bioclimates and forests in French Guiana and in the mountainous islands. Thanks to the overseas territories, France has the second largest maritime space in the world. Knowledge of the state of fisheries resources suggests that there will be a strong impact on the migrations of species and deterioration of living environments. As of now, tourism development plans need to integrate parameters related to climate change: maintaining biodiversity resources and climate conditions are indeed essential assets for tourism, especially tropical tourism.

Finally, risk management needs to be considered in the broad sense, whether in terms of human health, coastal zone management, or other climate risks related to territorial development. Health risks are beginning to be handled better, with an anticipated impact on four types of health conditions: illnesses related to heatwaves and intense periods of hot weather, illnesses related to the increase in solar radiation, vector-borne diseases, and water-borne and food-related diseases (ONERC, 2012). Island and coastal territories on average have high levels of exposure to coastal risks (coastal erosion, marine flooding, land movements and salinization), which are exacerbated by the high concentration of habitats, economic activities and infrastructure on coastlines. Territorial development schemes and local urban plans must necessarily take them into account.

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