

BRIEFING NOTE:

Vulnerability of African Rural Road Infrastructure to Climate Impacts - How to Improve Resilience

AfCAP Project on Climate Adaptation: Risk Management and Resilience Optimisation for Vulnerable Road Access in Africa (Reference GEN2014C, August 2017)

Context

The African Development Bank (AfDB) states that Africa is one of the most vulnerable regions in the world to the impacts of climate change. The majority of studies suggest that damages to roads from climate change, relative to population and GDP, will be higher in Africa than in any other region in the world (AfDB, 2011). Its studies suggest adaptation costs in Africa in the region of \$20-30 billion per annum are required over the next 10 to 20 years. This Briefing Note has been prepared for Senior Officials in Government to create awareness of the scale of the challenge and provide guidance on how to deal with the threats economically and on how to make road infrastructure more resilient, thereby improving socio-economic development through improved accessibility.

Africa has experienced dramatic changes to the continents' climate, which is causing widespread damage to road infrastructure and its associated assets. Rural accessibility is being compromised in a number of countries for increasing proportions of the year, creating both direct and indirect adverse effects on livelihoods and associated socio-economic development.

In the past four decades (1975-2015) African countries have experienced more than 1,400-recorded weather-related disasters. These disasters have had significant impacts on affected countries' economies and, in particular, on rural communities and their livelihoods. The impacts of these natural hazards (floods, storms, droughts, extreme temperature, landslides and wildfires) were also felt across all economic sectors and Infrastructure. Many communities and countries in Africa are socially and economically vulnerable to extreme climate events. Low adaptive capacity, as well as their high exposure to natural hazards, has resulted in the death of more than 600,000 people (of which the majority due to droughts), left 7.8 million people homeless (of which 99 per cent due to flooding and storms) and affected an estimated 460 million people over the past four decades (CRED, 2016).

Governments are facing a substantial backlog of damage to existing infrastructure assets caused by the effects of changing climate and are encountering difficulties in dealing with either appropriate design or maintenance of roads. These challenges impact on the mobility and access needs to socio-economic opportunities of rural communities in particular.

A Consortium led by the Council of Scientific and Industrial Research (CSIR), South Africa, appointed through the UKAid funded Africa Community Access Partnership (AfCAP) was commissioned in 2016 to deliver this guidance. The fundamental **project objective** is to identify, characterise and demonstrate appropriate engineering and non-engineering adaptation procedures that may be

implemented to strengthen long-term resilience of rural access. The second objective, which focuses on **capacity building and knowledge exchange**, is to meaningfully engage with relevant road and transport Ministries, Departments and Agencies/Authorities in a knowledge dissemination and capacity building programme based on the outputs from the research.

These adverse effects can now be dealt with much more effectively in order to minimise disruption to rural communities. A new Handbook and associated Guidelines on methodologies for dealing with climate effects and threats - with formulation of appropriate adaptation measures to make road infrastructure more resilient - will be published in early 2018 after their validation in the field (i.e. on demonstration projects in Ethiopia, Ghana and Mozambique). This Handbook and its associated Guidelines will assist road authorities, as well as civil engineering consultants and contractors, to deal with climate effects on rural maintenance backlogs, on road rehabilitation and also with the challenges to develop new road infrastructure.

The Scale of the Challenge

There is clear evidence that climate change has already affected the magnitude and frequency of climate extremes causing damage to infrastructure and dislocating rural communities. Particularly vulnerable AfCAP partner countries are Ethiopia, Kenya, Mozambique, Ghana, South Sudan, Tanzania, and Uganda; however, all African countries are affected.

The predominant types of recorded weather-related disasters for sub-Saharan countries and the amount of people that have historically been affected, are illustrated below in Figure 1. The size of the pie charts depicts numbers of people affected relating to the significance of the events.

Internationally, Development Partners are substantially increasing their Adaptation programmes. For example, the Asian Development Bank (ADB)'s total adaptation financing increased from \$558 million in 2011 to a planned \$988 million in 2013, an increase of approximately 77% (ADB, 2011).

The African continent is facing a potential direct liability of over \$150 billion to repair and maintain existing roads damaged from temperature and precipitation changes directly related to projected climate change. The liability does not include costs associated with impacts to critically-needed new roads, nor does it include indirect socio-economic effects generated from dislocated communities and from loss of rural access (Chinowsky et al., 2013).

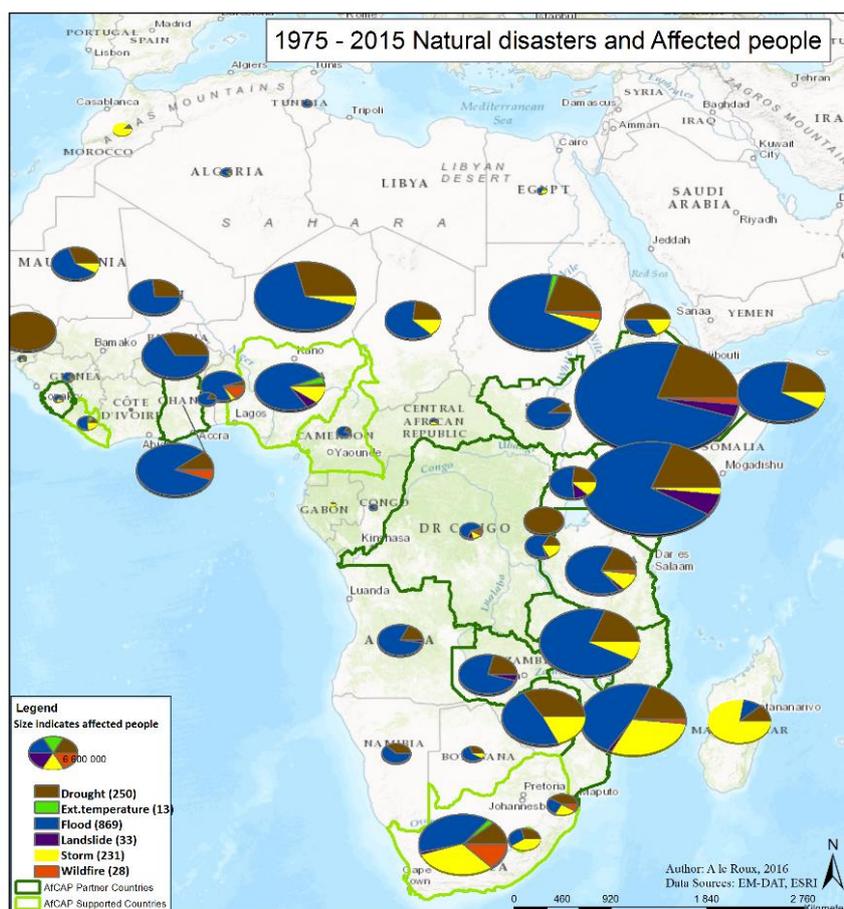


Figure 1: Recorded weather-related disasters and affected populations (CSIR. 2016)

It is estimated that an additional 230 million people will live in rural areas in the 12 AfCAP partner countries by 2050, making rural accessibility and mobility a high priority in Africa (UN-ESA, 2014), see Table 1 and Figure 2.

Table 1: Rural Population growth in AfCAP partner countries

| <i>AfCAP countries and partner countries</i> | <i>2015 - 2050 Rural growth ('000)</i> | <i>Urban % 2015</i> | <i>Urban % 2050</i> |
|--|--|---------------------|---------------------|
| Ethiopia | 37 375 | 19.5 | 37.6 |
| Uganda | 37 033 | 16.1 | 32.1 |
| Democratic Republic of the Congo | 20 456 | 42.5 | 60.4 |
| United Republic of Tanzania | 25 085 | 31.6 | 53.0 |
| Kenya | 19 766 | 25.6 | 43.9 |
| Mozambique | 12 105 | 32.2 | 49.1 |
| Malawi | 14 274 | 16.3 | 30.2 |
| Zambia | 9 278 | 40.9 | 58.3 |
| South Sudan | 6 490 | 18.8 | 33.9 |
| Ghana | 1 075 | 54.0 | 70.5 |
| Sierra Leone | 607 | 39.9 | 57.2 |
| Liberia | 1 005 | 49.7 | 65.2 |

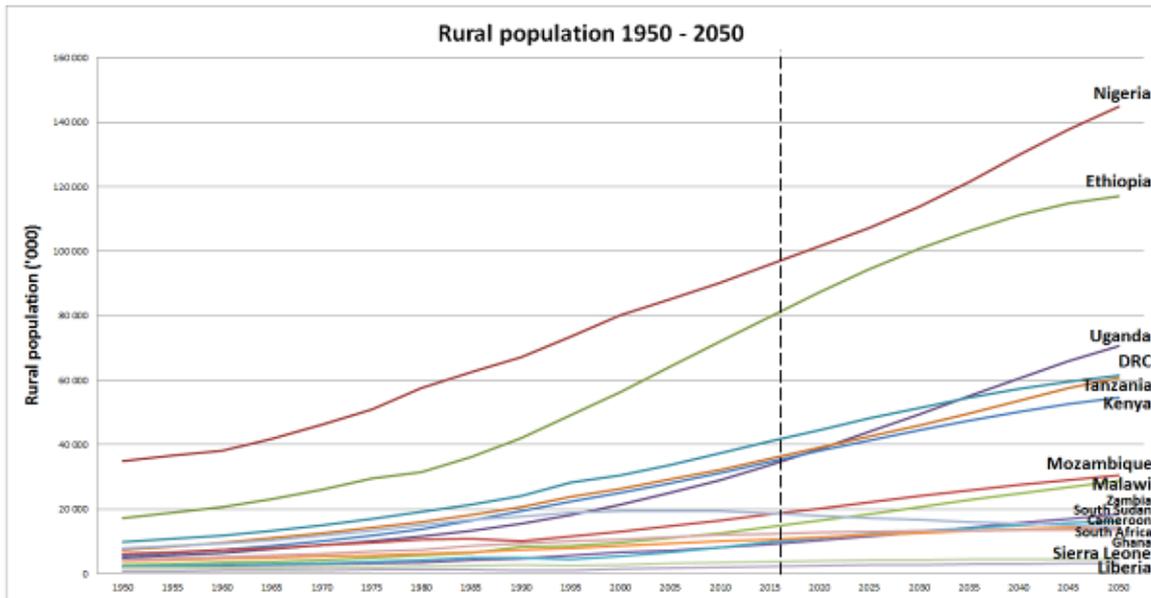


Figure 2: Projected increase in rural population between 2016 and 2050 based on historical data

Guidance is needed for road authorities/owners to identify the threats that are posed by climate change, to develop adaptation approaches to the predicted changes, to incorporate changes into mid-range and long-term development plans, and to secure funding for the proposed and necessary adaptation.

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Situational and needs analysis

A survey of affected countries, followed by meetings with relevant Governments and stakeholder workshops, has revealed similar experiences and circumstances between the countries to be addressed urgently:

- Road damage backlogs from climatic effects are increasing at an alarming rate and need appropriate guidance to address them;
- Maintenance budgets are not adequate to deal effectively with climate effects requiring better *Return on Investment* and help with a *Do Nothing / Do Minimal* approach;
- Appropriate new policies and strategies need to be embedded in plans, programmes and projects;
- Knowledge and capacity on climate adaptation needs strengthening;
- Relevant climate-related data needs to be collected to support a new approach;
- A manual, supported by Guidelines, should be developed and training given on its approach and implementation;
- The manual should be used on demonstration sites to show good practice;
- Training should be all levels and across all relevant stakeholders;

- Assistance to relevant government departments is needed to allow more effective engagement with multi-lateral and donor agencies, with evidence to support funding applications.

New Guidance Implementation

Based on the needs analysis, the consortium carries out research into appropriate and economic methodologies for vulnerability and risk assessments; prioritisation of adaptation interventions; and optimisation of asset resilience in the context of rural access. In addition, evidence of cost, economic and social benefit for rural communities arising from more resilient rural access is required to support wider policy adoption across Africa.

The research project focuses on: (a) demonstrating appropriate engineering and non-engineering adaptation procedures; (b) sustainable enhancement in the capacity of three AfCAP partner countries; (c) sustainable enhancement in the capacity of additional AfCAP partner countries; and (d) uptake and embedment across AfCAP partner countries.

A Handbook is being developed to address climate adaptation in a new and practical way. It will cover a wide range of climatic, geomorphologic and hydrological circumstances, based on application to Mozambique, Ghana and Ethiopia, but equally applicable to any Sub-Saharan country. Although it will be produced for *low volume roads*, the principles will also apply to *high volume roads*, although there will be differing priorities and design parameters.

There are three specific, overlapping applications of the Handbook:

- New Infrastructure and structures
- Rehabilitation and retrofitting
- Maintenance

There are five stages in the adaptation process, depicted in Figure 3:

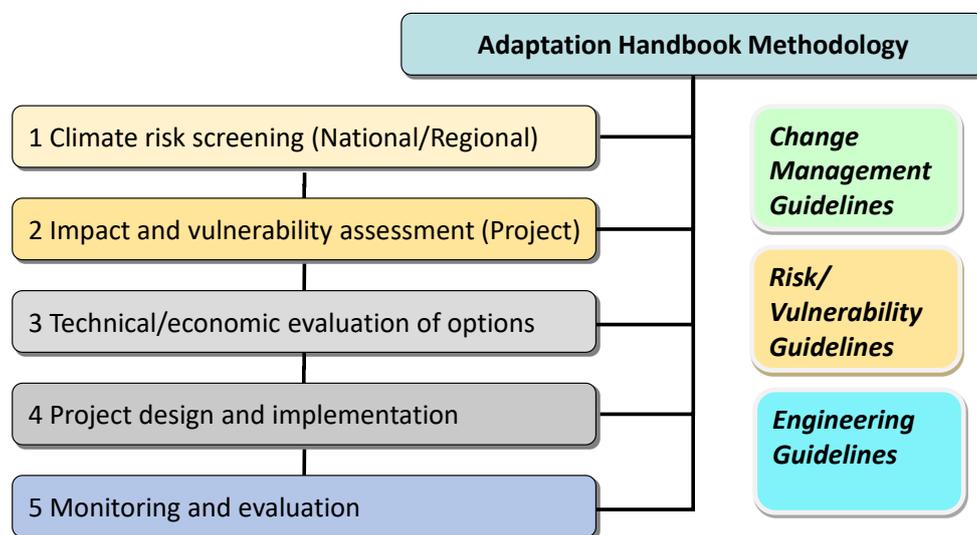


Figure 3: Outline of the Handbook and supporting Guidelines

The Handbook will set out the overall approach and will be supported by the following technical Guideline documents:

- Change Management Guidelines
- Climate Threats and Vulnerability Assessment Guidelines, and
- Engineering Adaptation Guidelines.

What outcomes are expected of using the Handbook and associated Guidelines?

It is expected that, through application of the Handbook and Guidelines:

- The existing road network will be made more climate resilient
- Much improved investment decisions will be possible
- Maintenance costs will be reduced
- Most of the threatened damage will be averted
- Improvements in accessibility will bring significant socio-economic development

What actions are required?

The following actions should be considered for implementation by Government:

- Issue of a policy statement setting out the scope and purpose of *Climate Adaptation for Roads* and associated assets
- Nomination of an officer responsible for Climate Adaptation implementation
- Drafting and consultation on a Climate Adaptation Strategy
- Consultation on augmenting National Adaptation Committees
- Development of a *Climate Adaptation* implementation programme
- Development of a capacity building programme
- Augmentation of national design Standards.

Who do you contact for assistance?

The project team is working in Ethiopia, Ghana and Mozambique until the end of 2018 and is supporting other AfCAP countries who are interested in sharing experiences. A CSIR led consortium comprises:

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