Integrated management of rural sector resilience to climate risks in Burkina Faso:
Theoretical approach

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Basically, for the people of Burkina Faso (Sahel region), the threat pose by climate and environmental changes is a loss of developmental achievements and prospects. In managing this threat, special attention should be given to the rural sector. It is a preponderant pillar of the national economy, by the proportion of the employed population and the contribution to the gross domestic product (GDP). About 40% of GDP comes from agriculture, livestock and the exploitation of natural resources, which are economic sectors and resources particularly concerned by climate change.

This bulletin proposes a theoretical approach for a management of the resilience of the rural sector to climate risks which integrates the interactions between the production systems and natural resources. In this approach, a three-component vector (e) is associated with the rural sector, such as:

\[
\begin{align*}
e_1 &= \textit{agriculture}; \\
e_2 &= \textit{livestock}; \\
e_3 &= \textit{water resources}
\end{align*}
\]

The specific case of one climatic risk (r) affecting (e) is considered.

In the case of a non-integrated assessment of the impacts of climate risks, the subsets of de1, de2 and de3 are considered: a) de1 the subset of the direct and indirect impacts of r on e1; b) de2, the subset of the direct and indirect impacts of r on e2 and c) de3, the subset of the direct and indirect impacts of r on e3.

The elements of de1, de2 and de3 come respectively from the three impact chains ce1, ce2 and ce3:

\[
\begin{align*}
\text{ce}1 &\equiv e_{1do}, e_{1d1}, ..., e_{1dm}; \\
\text{ce}2 &\equiv e_{2do}, e_{2d1}, ..., e_{2dm}; \\
\text{ce}3 &\equiv e_{3do}, e_{3d1}, ..., e_{3dm}
\end{align*}
\]

As indicated in subsequent publications (www.cres-edu.org), in a chain of impacts, eido is the direct impact of the risk on the component ei (i = 1, 2, 3); b) e1d1, the first order indirect impact and eidm, the indirect impact of order m.

In an integrated assessment of the impacts of climate risks, the interactions that the various components of a system have between them are taken into account. These interactions generate variations of the subsets of impacts of climate risks.

Figure (1): Schematic illustration of the interactions between e1, e2 and e3
1/ Variation of $\delta e_2 e_3(e_1)$

The interactions of $e_2$ with $e_1$ and $e_3$ with $e_1$, as illustrated by the figure (2), induce a variation $\delta e_2 e_3(e_1)$ of $de_1$.

![Figure (2): Schematic illustration of the interactions of $e_2$ with $e_1$ and $e_3$ with $e_1$](image)

Practically, $\delta e_2 e_3(e_1)$ results from the combination of two subsets, $de_2 e_1$ and $de_3 e_1$. They are the two groups of adverse consequences that are generated respectively by $e_2$ and $e_3$ for $e_1$.

Specifically:

- $de_2 e_1$ elements are the adverse consequences of the elements of $de_2$ for $e_1$. They are $e_2 d_0 e_1$, $e_2 d_1 e_1$, ..., $e_2 d_m e_1$. By definition, $e_2 d_l e_1$ is the most significant immediate adverse effect of the impact $e_2 d_l (l = 1, 2, ..., m)$ for $e_1$.

- The adverse consequences of the elements of $de_3$ for $e_1$ are the elements of $de_3 e_1$. Those are respectively $e_3 d_0 e_1$, $e_3 d_1 e_1$, ..., $e_3 d_m e_1$. An element $e_3 d_p e_1$ is the most significant immediate consequence of the impact $e_3 d_p (p = 1, 2, ..., m)$ for $e_1$.

2/ Variation of $\delta e_1 e_3(e_2)$

The interactions of $e_2$ with respectively $e_1$ and $e_3$, as illustrated in figure (3), they produce a variation $\delta e_1 e_3(e_2)$ of $de_2$.

![Figure (3): Schematic illustration of the interactions of $e_2$ with $e_1$ and $e_3$](image)

To establish $\delta e_1 e_3(e_2)$, two subsets $de_1 e_2$ and $de_3 e_1$ are specified:

- $de_1 e_2$ includes the adverse consequences of the elements of $de_1$ for $e_2$. They are $e_1 d_0 e_2$, $e_1 d_1 e_2$, ..., $e_1 d_m e_2$. $e_1 d_k e_2$ is the most significant immediate consequence of the impact $e_1 d_k (k = 1, 2, ..., m)$ for $e_2$.

- $de_3 e_2$ refers to the adverse consequences of the elements of $de_3$ for $e_2$. They are $e_3 d_0 e_2$, $e_3 d_1 e_2$, ..., $e_3 d_m e_2$. $e_3 d_p e_2$ means the most significant immediate consequence of the impact $e_3 d_p (p = 1, 2, ..., m)$ for the $e_2$. 
3 / Variation of de3

The variation $\delta e_{1e2}(e_3)$ of de3 results from the interactions of e3 with e1 and e2, as illustrated by the figure (4).

Figure (4): Schematic illustration of the interactions of e3 with e1 and e2

In practice, $\delta e_{1e2}(e_3)$ is the combination of two subsets de1e3 and de2e3, which are:

- the elements of de1e3 are the adverse consequences of the elements of de1 for e3. They are e1doe3, e1d1e3, ..., e1dme3. By definition, e1dle3 is the most significant immediate adverse effect of the impact e1dl (l = 1, 2, ..., m) for e3.

- the adverse consequences of the elements of de2 for e3 are the elements of de3e1. Those are respectively e2doe3, e2d1e3, ..., e2dme3. An element e2dpe3 is the most significant immediate consequence of the impact e2dp (p= 1, 2, ..., m) for e3.

The theoretical approach proposed in this bulletin can be easily extended to cases where several climatic risks have to be considered.
For drought, the analysis shows that the elements of $\delta e_{1e3}(e_2)$ are negative changes for the livestock sector, in particular a decrease of public financing of this sector development.