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Environmental Assessment
Dutch Sustainability Unit

# A Geopolitical Lens to Climate Smart Food Security Interventions

## DEVELOPING COUNTRIES

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# Advisory Report by the Dutch Sustainability Unit

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| **Subject** | **A Geopolitical Lens to Climate Smart Food Security Interventions** |
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# 1. Abbreviations

| | |
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| CSA | Climate-smart agriculture |
| DGIS | Directorate General for International Cooperation (of the Ministry of Foreign Affairs) |
| DSU | Dutch Sustainability Unit |
| FDI | Foreign Direct Investment |
| FNS | Food and Nutrition Security |
| GIS | Geographic Information Systems |
| WUR | Wageningen University and Research Centre |

# 2. Summary

The Netherlands has the objective to contribute to food and nutrition security and to climate goals by means of trade and aid. Reconsideration of the areas and countries of focus would benefit from a communicative geographic analysis that is easy to perform. Against this background DSU has answered the following questions at the request of DGIS.

**Theoretical question: Is a geographic identification of areas with high potential for effective climate smart aid and trade interventions in theory possible?**
Yes. Areas can be identified on map with high demand for food system interventions, by integrating factors like food and nutrition demand, yield potential and yield gap, and stability of governance. Distance to areas in need of food that are less likely to become sustainable producers (e.g. conflict areas) can be added to the map. Demand for interventions can be crossed with areas that have high opportunity for effective adaptation or mitigation measures. The latter can be based on production systems and populations in critical situations and therefore sensitive to climate change. Of these, the former is based on historic data for climate, soil and water availability, the latter based on living standards. The edges of areas with high demand for interventions can be sharply drawn with a small grid size GIS analysis based on all these assumptions, even if climate change itself is difficult to forecast with precision. Such a map may produce a surprising image of areas where trade and aid interventions would be most effective. Experts may then interpret the map and build a narrative to feed strategy development.

**Practical question: Is it possible to operationalise this theoretical method in a practical and useful way?**
Highly likely. The theoretical concept has been operationalised with a GIS system managed by the WUR on the basis of open source small grid data. It was applied to Mali and Burkina Faso, yielding a transboundary map of high (and low, medium) potential areas. This preliminary method has been discussed in detail in a wider expert group (see Colophon for the composition of the group) which believes that, with some modifications to the nature of basic data and their aggregation, meaningful maps can be produced. It is also likely that for any country, agro-economic and climate/water experts can be found capable enough to interpret the map and build a strategically useful narrative with limited effort. Experts may also give their views about the kind of opportunities for climate smart aid and trade interventions that are linked to areas on the map (e.g. where are the opportunities? At which scale do they occur? Which supply chains and institutional measures are opportune?). Strategists can use this geographic analysis to identify the jurisdictions to work together with to develop interventions. These jurisdictions may be located in parts of countries or in several countries. The method can be applied in theory for any country or region in the world (but it is discouraged to present GIS outcomes without an expert interpretation).

**Outlook: What next steps can be taken?**
Following further steps are suggested:

- The method can be further operationalized and adapted as a tool to support development of Multi-Annual Strategic Plans, food security investment plans, and serve as input to the appraisal of potential geopolitical externalities of climate resilience, like migration effects.
- The technical tool can be associated with a model to organise its application in a meaningful way (providing accurate expert interpretation and narratives about the maps).
- The improved tool and organisation model may be tested with the envisaged target group: the planning aid and trade strategists.

If successful, the method can be widely applied to make aid and trade aimed at food and nutrition security more climate-smart.

# 3. Introduction

The Food and Nutrition Security (FNS) and Climate Change (CC) clusters of the Dutch Directorate General for International Cooperation (DGIS) have asked the Dutch Sustainability Unit (DSU) to assess possibilities of applying a geopolitical climate 'lens" to food security interventions.

In a first phase, the DSU, with experts at Wageningen University & Research, has prepared an "attention point" of making Dutch FNS programmes "climate smart"[1]. This does not affect the primary objectives of these programmes. In a second phase, DGIS asked DSU to review possibilities of assessing which types of interventions into food security are climate smart in the first place: this time affecting their primary objectives. Which focus should such interventions have? How is this focus induced by climate change and related geopolitical considerations (i.e. assuming climate change operates as a threat multiplier particularly through its effects on food and water scarcity)? Can opportunities for climate smart FNS be mapped out for ex-ante appraisal? In a later stage, these opportunities may be compared to the actual Dutch portfolio.

This is not a simple question, as it pertains to the definition of "climate smart", "geopolitical", "FNS", "interventions" and "focus". A method needs to be developed, operationalised and employed to inform choices regarding investments which are designed to contribute to the international climate change objectives agreed upon in Paris, food security and the promotion of political stability. A decision was taken for phase 2 to become a feasibility study, which for reasons of simplicity would leave out climate change mitigation and be limited to sub-Saharan Africa. It may inform decision-making about interventions of the Dutch government and of the private sector home-based in the Netherlands.

The Paris Agreement (of December 2015) asks for "recommendations for integrated approaches to avert, minimize and address displacement related to the adverse impacts of climate change". The Dutch Cabinet indicates in its letter to the Parliament dated 8 February 2015, that "its premise is that climate change already has consequences for security and that will exacerbate in the future. Whereas the causality is complex, climate change is assumed to have a catalysing effect on other development problems, especially in fragile states. Therefore, the Cabinet considers a climate lens to be indispensable for any diplomat".

The current project does not have the objective to unravel causality between climate change, food security and geopolitical security as such. Alleviation of poverty and malnutrition for all people in sub-Saharan Africa may not be a sufficient condition for conflict security, but DGIS assumes that it is a necessary step to reduce the risk of insecurity. With this in mind, it wants to know if, and how, climate change should influence strategic choices in designing food security interventions.

[1] See dsu.eia.nl

Theoretically, in most of Africa crop yields can be three folded by land upgrading and intensification, even under conditions of climate change.[2] However, currently, this is only achieved in few places. Previous breadbaskets of Africa like Zimbabwe no longer provide food exports due to failing governance systems, which has even resulted in degraded lands. Should expectations of effective governance[3] be taken into consideration when designing interventions? Should transitions in food systems (the potential threefold yield rise) earn more attention than helping the resilience of traditional systems? And how should climate change scenarios – with a differentiated geographic impact – affect such priorities?

To structure these questions and determine a way ahead, DGIS has asked the DSU to address the following questions:

**Theoretical question: Is a geographic identification of areas with high potential for effective climate smart aid and trade interventions in theory possible?**

- How would one recognize **climate (adaptation) smart interventions** into the FNS system of sub-Saharan Africa? (Definition/delineation)?
- Which analysis – other than already available through the phase 1 report – is needed to **design such interventions**? (Appraisal criteria)?

**Practical question: Is it possible to operationalise this theoretical method in a practical and useful way?**

- What is needed for **mapping opportunities for climate smart FNS interventions** for sub-Saharan Africa to enable strategic discussion?
- How should such a map deal with the **heterogeneity of food systems and climate change issues** across Africa, and the economic relationship between regions in Africa?

**Outlook: What next step can be taken?**
If DGIS thinks the answers to previous questions are promising, how can it **further stimulate discussion about climate mart FNS interventions**?

The DSU has invited experts from Wageningen UR and Clingendael Institute to jointly answer these questions. From DGIS, Jeroen Rijniers has co-read this paper. The draft report has been circulated among other experts and discussed with most of them on 12 September 2016. See colophon for details.

[2] Source: Maja Slingerland (2014),

[3] see: Mandemaker, Bakker & Stoorvogel (2011); this study suffers, however, from methodological flaws since cross-section and time series data are combined and a multi-level approach should have been applied to identify the specific effects of governance on agricultural growth.

# 4. Theoretical questions

## 4.1 How would one recognize climate (adaptation) smart interventions?

According to DGIS policy, Dutch development aid should take climate change into consideration, making it “climate smart”. This may be interpreted as the ambition of achieving development cooperation objectives, whilst at the same time also making use of opportunities to reduce greenhouse gas emissions, and reducing the impact of climate change (i.e. adaptation). This ambition is closely related to the Sustainable Development Goals set for 2030 agenda and the international initiative on climate smart agriculture.

International obligations to finance climate change mitigation and adaptation have been measured by means of so-called OECD Rio Markers, which are based on (ex- ante) donor intention rather than (predicted ex post) impact. The Paris Agreement in the UNFCCC process (December 2015) “recognizes the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems”, and aims at “increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production”.

The above does not really help to further specify the nature of climate smart interventions to alleviate poverty and malnutrition. It seems in the spirit of the Dutch policy to assume that such interventions are climate (adaptation) smart if:

- They are designed in such a way that climate change will not unnecessarily go at the expense of reaching their primary goal (**Climate Robustness**). Such design principles have already been identified in first DSU report and will not be considered further hereafter.
- They are designed to achieve most impact per unit input in terms of reduction of poverty and malnutrition in Africa, taking into account the impact of climate change (**Climate Efficiency**). Design has therefore to take into consideration the potential of producing food and making it available to people affected by climate change. This potential is likely to depend on circumstances that highly vary across Africa.
- They are able to cope with expected climate impacts in a mid to longer term perspective, whilst taking account of changing economic, political and demographic conditions. This means that these interventions contribute most to reliable and responsive food security systems which should be flexible enough to adapt to changing conditions like urbanisation (**Climate Resilience**).
- The climate smartness (with the above criteria) is shown through an analysis that takes the long term into consideration, as many climate scenarios in particular forecast structural change in the long term. This analysis should be shared by all stakeholders who have some role in the intervention (**Climate Sustainability**).

To move these criteria (Climate Robustness, Climate Efficiency, Climate Resilience and Climate Sustainability) beyond the level of good intentions, they need to be operationalised, for which we do proposals hereafter. We do not operationalise hereafter each criterion individually, but the whole set at once: in such a way it is not a problem if there is overlap between the criteria.

It is not expected that, without changing geographic focus, the whole Dutch FNS portfolio in Africa can be redesigned in such a way that it fully meets these criteria, but a discussion about the benefits of partial redesign may be useful. In addition, this new thinking about climate smart FNS may also affect the nature of interventions. The following table gives an idea of the adjustment variables interventions should be designed for[4].

| Change pattern | Time frame | Adjustment variables |
|---|---|---|
| Climate Efficiency | Short-term | Changes in Farming systems (input use intensity) |
| Climate Resilience | Mid-term | Integration into Food Chains (transactions, prices) |
| Climate Sustainability | Long term | Responsiveness & adaptive capacity of Food Systems |

## Non-technical assumptions

With a view to the above mentioned Cabinet letter to the Parliament (8 February 2015), the criteria set above as covering climate smart interventions requires two non—technical assumptions:

- **Willingness to assume a positive causal correlation between food security and stability.** Interventions in food systems that are affected by climate change may also be considered to be climate smart if they are designed to reduce political instability. This is not a new criterion if we assume that comparable levels of food insecurity cater to comparable levels of political instability, anywhere in Africa. Both objectives then will coincide. In reality, this assumption may not be true. Some cities may be well nourished and the marginal effect of more food security in these cities may not cater to less marginal effect on stability than in less well-nourished cities. On the other hand, the better-provided cities may attract migrants, which would balance out the difference. This relationship is not well understood and therefore hard to operationalise.

- **Willingness to prioritize long-term resilience over short-term food security in the most vulnerable areas.** Does a donor want to invest with priority in areas where aid effectiveness might be lower in terms of "livelihoods saved on the short term", but higher in terms of net return on investments? In the latter case, people may migrate to safe areas, at a larger scale resulting in more long-term stability.

For the sake of argument, we assume there is a willingness to assume a positive relationship between resilience and effective governance on the one hand and "strong market infrastructure" on the other hand (see also below), and to prioritize long-term large scale stability. In future research it might be relevant, though, to look more closely into the relationship between food interventions, political stability and the possible contribution to preventing conflict.

[4] This integrates with the recommendations done in the climate lens 1 report, where the question has been answered in the reverse way: by assuming an intervention's FNS objectives already are defined and it may be adjusted to become more climate smart

## 4.2 Which analysis is required to design climate smart food and nutrition security (FNS) interventions?

With the above criteria, looking for the most climate smart FNS interventions in Africa is still not straightforward. For simplicity, it may be assumed that currently unproductive parts of Africa will not become productive in the future, as most of these will be either remote, unfertile or protected; to that end the DSU experts believe it is reasonable to leave the 20% least productive (in terms of food for Africa itself) surface area out of the analysis.

Further operationalisation will depend on many – often locally determined – circumstances:

- [FOOD PRODUCTION] The smartest localities for climate smart interventions may have to be identified with a small "grid size" (10 km x10 km) if these need to take into account the local physical (soil, water, climate) and socio-economic (finance, markets, governance) conditions of the agro-food system that determine the feasibility and cost of increasing crop yields. How can this be mapped for the whole of Africa?
- [FOOD TRADE] The theoretical yield potential may be difficult to attain, and if it is attained the produced food may not reach the population that is most undernourished, if there are no effective institutions in place for linking production through trade/transport/storage to distribution/consumption. In dynamic conditions like urbanisation, governance needs to have adaptive capacity as well. It has to enable an increase in rural labour productivity in order for cities to be fed. Moreover, maintaining people involved in agriculture requires also raising returns to labour and rural wages. How can this be mapped for the whole of Africa?
- [FOOD DEMAND] Interventions need to respond to ongoing and foreseeable transitions of the spatial economy, that is, where economic activity occurs and why. The most salient aspects of the spatial economy are urbanisation, industrialisation and development toward a (low end) service economy, often in association with the emergence of urban pockets of poverty. This implies that dietary transitions and transport/distance become key parameters of food demand. Another important one is the transition to production for the international market; workers in this industry earn money that they can spend on food – which will then have to be produced elsewhere. The emergence of international markets offers opportunity for international value chain integration and corporate social responsibility. How can interventions anticipate on such transitions?

# 5. Practical questions: operationalisation

## 5.1 What is needed for mapping opportunities for climate smart FNS interventions to enable strategic discussion?[5]

Mapping of areas with high and low potential for effective and efficient interventions to alleviate poverty and malnutrition may stimulate discussion about what is needed to better justify interventions. To that end, such maps should at least give a strong indication of that potential: current portfolios and proposed intervention strategies may be tested against it. If interventions and high potential areas are not overlapping, there is reason for further scrutiny. If they do overlap, there still may be such reason, because not only the location of the interventions matters, but also their impact.

Interventions are usually organised at the level of countries, regions in countries, and transboundary regions. “Areas of equal yield potential” may be much smaller. For salience to the potential users of the maps, the designers of interventions, rather the “grid size” should be applied that they already use; the geographic boundaries of joint actions that emerge through the application of systems thinking, i.e. along value chains and / or landscapes. Areas with a large yield gap theoretically have relatively more potential to increase food security at lower unit costs. But that is not the only relevant factor. Should the international community focus on West Africa (low investment, high yield gap), or in East Africa (higher investment, medium yield gap)? Should they intervene in North Uganda, or in South Uganda? Answering such questions calls for some way of homogenising a differentiated area, including aspects of population density, food security potential and risk incidence. This is further considered in the following paragraph.

Assuming homogenising is successful, some kind of systems thinking should be applied to make boundary judgements of intervention areas with high or low potential. There are different possibilities for criteria of boundary judgements, that all may be used according to conditions in the field:

- rural areas with some dominant or more diversified food production systems[6];
- urban growth poles that develop food market relations with their hinterland;
- larger corridors of food production and consumption.

The map of Africa would therefore consist of a mosaic of these three types of units, some of which may overlap.

Once the mapping units have been chosen, each unit (rural area with the same dominant food system, urban pole or corridor) has to be classified as “high” or “low” potential. Here, the following matrix may be helpful:

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[5] This is consistent with existing approaches like proposed in Realising the promise and potential of African Agriculture, Report of the Ad-Hoc Follow-up Committee of the inter Academic Council, October 2005.

[6] see: Dixon. J. & Gulliver, A. (2001) Farming Systems and Poverty. IMPROVING FARMERS' LIVELIHOODS IN A CHANGING WORLD. FAO: Rome

| | | Food system dynamics | |
|---|---|---|---|
| | | Low | High |
| Climate dynamics | Low | A. Medium potential for FNS interventions (yield may be increased but demand is not growing as much) | B. High potential for FNS interventions (strong investment potential, relatively easy physical conditions) |
| | High | C. Low potential for FNS interventions (preserving local systems that have little yield potential at high cost) | D. Medium potential for FNS interventions (investment potential is high, but agro-ecological conditions make it difficult) |

*Table 1: Possible dimensions for the FNS-CSA potential of a geographic unit*

The following criteria are theoretically available for this classification:

| Food system dynamics | |
|---|---|
| **Low** | **High** |
| Low demand from nearby cities | High demand from nearby cities (or harbours) |
| Scarce market infrastructures | Strong development of market infrastructures |
| Little presence of banks/investors | Much presence of private investors |

As regards to climate dynamics, a combination can be sought of the expected climate change and the vulnerability of the production system to that, depending on available data for both at small grid size.

Once all units have been classified according to their potential, a sensitivity analysis is necessary to allow for interactions with neighbouring areas. To better reflect real opportunities, the applied class of a unit may have to be adjusted, for example, if an urban pole is likely to be outcompeted or if a unit is so well nourished that food security cannot become a security issue. (However, see the reservations above about the available knowledge about this relationship).

### Link with effective governance and political instability

The criterion above "scarce / strong development of market infrastructures" (which include land governance, physical infrastructures and market institutions), can be taken as the first proxy for effective resource governance as a stable context of food systems. The second context factor is political (in)stability. In the proposed approach, this is represented by the proxy "little/much presence of (public) market infrastructure". It is assumed possible to represent this proxy as an indicator for the prospects for private Foreign Direct Investment (FDI) for all units on the map. For parts of Africa there are better sources, however. Recent research gives first insights into areas that are at risk for conflict in the Sahel and the Horn of Africa regions (see http://www.inform-index.org/Subnational). These areas are vulnerable for climate change, and most probably private banks/investors have less interest for these areas. The implication is that the darker areas in the figure will usually be categorized as "low food system dynamics" and "high climate dynamics" and therefore having low FNS-CSA investment potential. The authors are aware that this method of categorizing may not represent the subtler factors that also may influence potential.

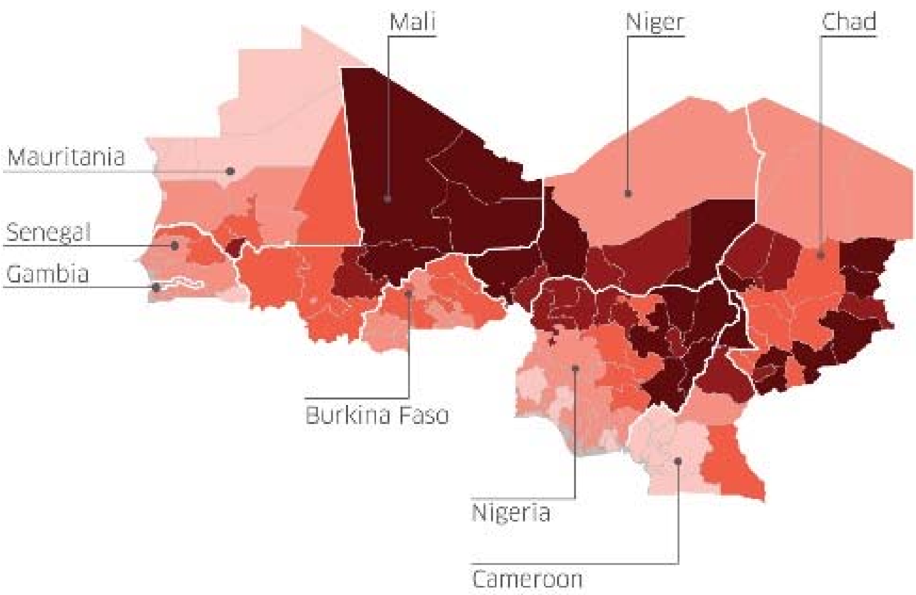



*Figure 1: Darker areas are at risk of conflict, according to inform-index.org*

## 5.2 How should such a map deal with the heterogeneity of food systems and climate change issues?

Case countries Mali and Burkina Faso have been selected to further operationalize and test the approach: climate change is expected in these countries and some areas are vulnerable to that: IPCC climate change scenarios show that their whole combined territory is at risk of changes in temperature and precipitation. "Temperature projections over West Africa for the end of the 21st century from global climate simulation range between 3 and 6 °C above the late 20th century baseline depending on the emission scenario. (..) "precipitation is more uncertain than temperature" (.. ) there is a low confidence of the delay in the onset of the West African rainy season with intensification of late-season rains in the latest projections"[7].

Knowing this, the method can be applied without the need to inaccurately downscale to small grid the available maps showing climate change scenarios.

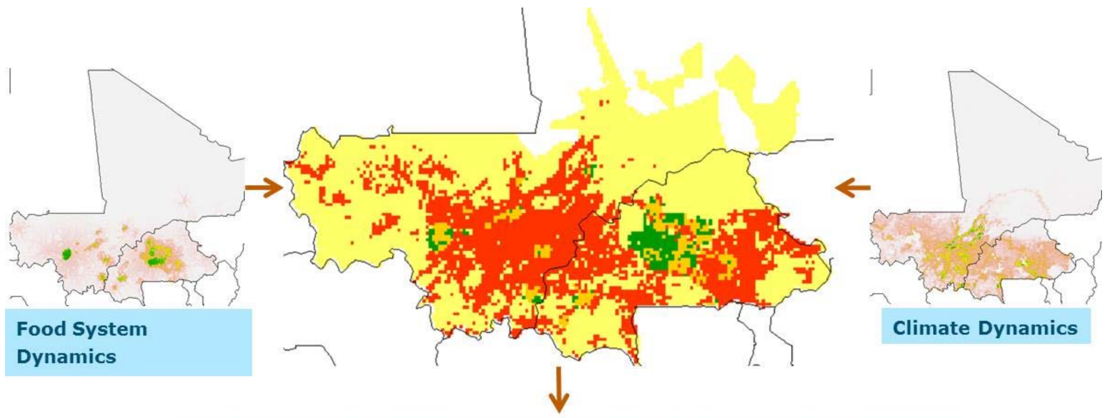
Both countries are mapped, whereby each grid is classified as "high" or "low" potential with respect to both food systems dynamics and climate dynamics. By means of including and weighing several indicators the classification is operationalised (as indicated above, without specifying scenarios for climate change at small grid scale)[8]. The aforementioned classification will result in a 2*2 matrix with quadrants A, B, C or D (Table 1).

[7] See Jens O. Riede, Rafael Posada, Andreas H. Fink and Frank Kaspar, 2016. What's on the 5th IPCC report for West Africa? In: Adaptation to Climate Change and Variability in Rural West Africa. Springer. (The 5th IPCC report itself has only a very indicative map of Africa showing scenarios for future climate).

[8] See underlying report: Ruben, R., Hennen, W., and Van Asseldonk, M. (2016). Mapping high/low food system dynamics and high/low climate dynamics. Wageningen Economic Research.

Given the base scenario (i.e., current situation) mapping results are depicted in Figure 2, and with varying resolution (minutes longitude/latitude) in Figure 3. The maps for food system dynamics and climate dynamics, which are derived from the Global-Detector indicators, are combined in a map showing the potential for climate smart FNS. Urban regions with a high value for food system dynamics have a high (green) or medium (orange) potential. This holds especially for the urban regions of Ouagadougou, and to a lesser extent Bobo-Dioulasso in Burkina Faso and Bamako, Sikasso, Koutiala, Ségou and Mopti in Mali. Rural regions with a low value for food system dynamics have a medium (yellow) or low (red) potential. Areas with negligible population on a grid cell are excluded, e.g. the Sahara Desert.

The advantage of the presented mapping approach is that it is a systematic approach (repeatable in other areas by using open source data) within a flexible framework (new information can be added and underlying indicators can be alternatively weighed).




| Index [% of area] | Food System Dynamics Low | Food System Dynamics High |
|---|---|---|
| Climate Dynamics Low | Medium [yellow, 62.0%] | High [green, 2.7%] |
| Climate Dynamics High | Low [red, 31.6%] | Medium [orange, 3.8%] |

*Figure 2: Mapping results: areas with high, medium and low potential for climate smart interventions into food systems*

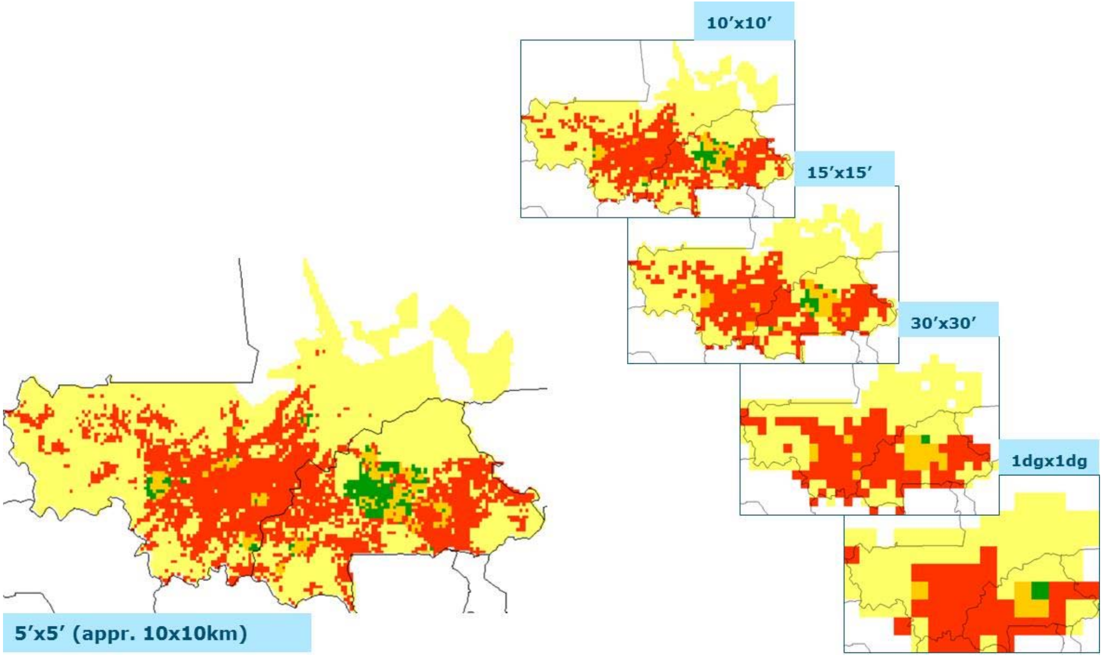
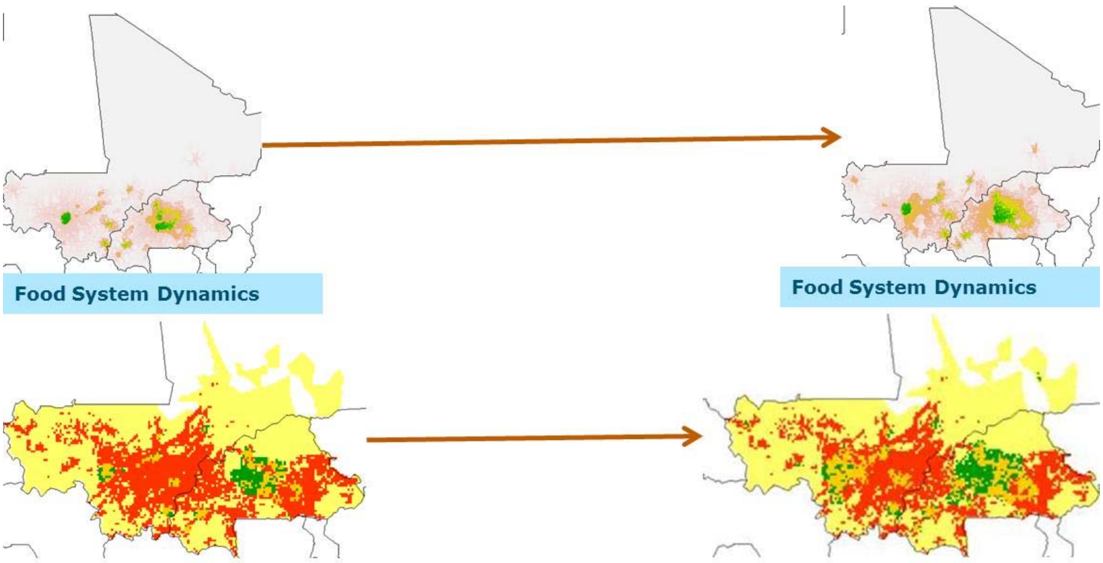



*Figure 3: Results with varying resolution (minutes longitude/latitude)*

In addition, a scenario is analysed to determine the impact of population increase from 2015 to 2030 on the potential for climate smart FNS interventions (Figure 4). Population increase is derived from World bank statistics and assume increase of 60% in Mali and 48% for Burkina Faso. Assumed is that increase is proportional in rural and urban areas. Due to increasing population density the areas increase where Food System Dynamics is high (green and orange areas).




| Index | Food System Dynamics Low | Food System Dynamics High |
|---|---|---|
| Climate Dynamics Low | 62->59.9% [yellow] | 2.7->5.0% [green] |
| Climate Dynamics High | 31.6->26.6% [red] | 3.8->8.7% [orange] |

*Figure 4: Mapping results of scenario population increase*

## Assessment by a wider expert group

The assessment of the Proof of Concept outlined above by the wider expert group informed about opportunities and requirements for the further operationalization of this approach for policy purposes. The spatially-explicit food systems approach enables to identify suitable areas for specific types of interventions.

The application of the analytical framework can be enriched by addressing the following key challenges:

- Scaling: much detailed information on resource variability is available at high density grid level (soil potential, water, accessibility), whereas risks from climate change dynamics and political instability are usually projected at higher scale level (sub-region, department). Also socio-economic indicators (e.g., household income and savings, expected population increase) are currently only available at country level.
- Timing: expected changes in climate dynamics and in food systems may become manifest at different time scales; it is therefore important to focus on the earliest constraint that is likely to be met.
- Space: climate change is likely to shift the 'feasible' region for FNS programs. Some sub-zones are connected to other zones (e.g. migratory herders) that ask for integrated spatial analysis.
- Climate mitigation and adaptation options need to be distinguished: the former mainly in Section D and the latter in Sections A and B.
- Mobility and Migration are considered as 'outcomes' of critical FNS conditions that can be partly addressed through (local) CSA resource intensification.
- Robustness and Resilience are considered by incorporating climate variability and specifying local buffer stocks.

It should be remembered that even without these improvements the maps already give valuable clues to experts who are familiar with the local situation. Moreover, even with all suggested improvements, FNS strategists should not be encouraged to use the maps without the help of such experts.

# 6. Outlook: What next steps can be taken?

The proof of concept for integrated mapping of opportunities to support Climate-Smart oriented Food Security systems provides useful and actionable information to policy stakeholders and investors regarding their initial decisions on the location, the scale of operations and potential payoffs.

Following further steps are suggested:

- The method can be further operationalized and adapted as a tool to support to decision-making procedures[9] on, e.g.:
  - strategic country planning (e.g., Multi-Annual Strategic Plans);
  - for the assessment of food security investment plans;
  - serve as input to the appraisal of potential geopolitical externalities of climate resilience, like migration effects.
- The technical tool can be associated with a model to organise that planners are served with maps that are first interpreted by experts, who may provide possible narratives about opportunities in the specific region for climate smart FNS interventions.
- The improved tool and organisation model may be tested with the envisaged target group: the planning aid and trade strategists.
- If successful, the method can be widely applied to make aid and trade aimed at food and nutrition security more climate-smart.

[9] Another tool are the climate change profiles, available only for 16 current Dutch partner countries, which describe a.o. climate vulnerability and policies; see wwww.dsu.eia.nl