Netherlands Commission for
Environmental Assessment
Dutch Sustainability Unit

Advice on integrating environment, climate change and disaster risk reduction into the food security programme of the EKN

Desk study

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Netherlands Commission for Environmental Assessment
Dutch Sustainability Unit

Advisory Report by the Dutch Sustainability Unit

Subject:	Advice on integrating environment, climate change and disaster risk reduction into the food security programme of the EKN Burundi

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1. INTRODUCTION

The food security programme of the Royal Netherlands Embassy of Bujumbura (EKN Burundi) is intended to contribute to the embassy's goals on climate adaptation and ecological sustainability. The embassy is reviewing its current food security programme, to ensure that the cross-linkages between intensification of agricultural production, sustainable land use and climate adaptation are fully in view, and to include indicators with which the embassy can report on progress concerning its goals on environment and climate change. Simultaneously the programme of the EKN including its food security component is being reviewed by other experts to strengthen its gender focus.

The DSU received a request from the EKN to:

1. Review the integration of environment and climate, within the theme of food security into the current MASP 2012-2015;

2. Review the current portfolio of projects within the theme of food security, to check that environment, climate change and disaster risk reduction are optimally integrated, and to give concrete recommendations to strengthen these topics where optimization is possible;

3. Propose a set of indicators for the food security programme on environment, climate change and disaster risk reduction. These indicators will form the basis for progress reporting by the embassy to DGIS, but they can also help to focus reformulation and implementation of the programme, if needed. The embassy is particularly interested in indicators on climate adaptation, because the food security programme offers opportunities to improve climate adaptation;

4. Advise on how to measure progress against the proposed indicators, using information from existing sources (such as the annual Enquête Agricole), preferably.

In line with the expected outputs, the DSU takes a practical approach in its advice, by providing recommendations for improving the integration of environment, climate change and disaster risk reduction in the MASP and the portfolio of projects with acceptable efforts, and proposing a set of indicators. The DSU proposes as much as possible existing indicators and pays attention to linkages with Rio Markers and gender aspects. The DSU also aims to harmonize the themes of environment, climate change and disaster risk reduction, especially in the choice of indicators, as there is much overlap.

2. CONTEXT INFORMATION ON THE THEMES

The EKN (Royal Netherlands Embassy) programme in Burundi focuses at three provinces: Bujumbura Rural, Bubanza and Cibitoke. These provinces are covered in a variable degree by three different eco-types: Mugamba (high altitude), Mumirwa (middle altitude) and the Imbo (the plains). The latest maps published by the Government of Burundi[1], show that these are provinces with a high risk of land sliding and a high degradation index. Cibitoke and Bubanza are also provinces where droughts may occur more often in the near future due to climate change.

From an environment point of view, the critical ecosystems in Burundi are the lowland wetlands, the upland forests and hill-slopes. The wetlands or marshes (marais) are a valuable resource to Burundi for their ecological products and services. Services include water table recharge and flood control, both being important for sustaining food production in the plains and for security of people. Wetlands also produce peat (a fuel alternative to firewood) and clay (for housing construction and brick-making). The wetlands are also important as a habitat for biodiversity and Burundi therefore currently has four protected Ramsar sites. Rusizi national park is severely threatened by erosion, over-exploitation of natural resources, and the use of fertilizers and pesticides for agriculture[2]. About 7% or 172,000 ha of Burundi is forested, of which 23% is primary forest, being the most bio-diverse and carbon-dense form of forest. Forests in Burundi provide important ecosystem services, especially soil protection, erosion control and watershed protection, which is important for provision of water and stabilization of agricultural croplands. Forests also provide fuel-wood[3]. Burundi lost 41% of its forest between 1990 and 2010[4]. Forests are threatened by felling of trees and cutting of bamboo, fire and encroaching agriculture.

Both management of wetlands, forested and sloping lands is increasingly important in view of climate change adaptation, in view of their buffering, carrying capacity and resilience oriented ecosystem functions. Attention for these land types is justified by the close overlap between the global objectives of (i) maintaining ecosystem functions and services for sustainable food production, (ii) biodiversity protection, and (iii) climate change adaptation (i.e. being a sink for CO_2).

The forecast of climate change in Burundi is characterized by a 1-2.5°C temperature increase in the coming decades. In addition, the number of unprecedented heat extremes will increase[5]. Prediction in precipitation ranges from losses of up to 100

[1] République du Burundi, 2013. Stratégie Nationale et Plan d'actions sur le changement climatique: p. 7 and 10.

[2] The Annotated Ramsar List of Wetlands of International Importance: Burundi. http://www.ramsar.org/cda/en/ramsar-pubs-notes-anno-burundi/main/ramsar/1-30-168%5E16691_4000_0__

[3] Carbon, biodiversity & ecosystem services: exploring co-benefits. http://www.carbon-biodiversity.net/Content/ShortProfiles/Burundi%20Profile%20110408_final.pdf

[4] http://rainforests.mongabay.com/20burundi.htm

[5] World Bank, 2013. Turn down the heat - Climate Extremes, Regional Impacts, and the Case for Resilience. A Report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. 213 pp.

mm/yr resulting in intermittent droughts (especially prevalent in the northern and eastern provinces) and a precipitation increase of up to 200 mm/yr intensifying the risks for flooding (especially prevalent in the Central plateau)[6]. Rainfall pattern changes may result in one rainy season (October/November – April/May) instead of actually two rainy seasons (September–December and February–June).

The need for climate change adaptation is illustrated by recent disasters: In 2007 almost 25% of the population have been hit by floods and needed assistance[7]. In 2011 food shortages are reported after heavy rains have damaged two harvests. 60% of crops, including banana, cassava and maize crop were swept away, which represent 15% of the annual production. More than 300,000 people remain affected.

Disasters associated with climate change in Burundi include:

- drought leading to: a) light to severe reduction in crop production [yield declines from five up to 25%[8]] and change in crops that can be grown, and b) reduced weight gain in cattle [sheep and goats are less sensitive to thermal stress] and starvation of livestock in extreme cases of thermal stress, and lack of water and fodder[9];
- flooding leading to soils and crops washed away, and more diseases (cholera, dysentery, Rift Valley Fever, and malaria) in these areas;
- increased incidence and range of pests and diseases for crops, livestock and natural vegetation;
- shortage of drinking water in larger parts of the year;
- health risks associated with migration to poor urban areas characterized by overcrowding and in-adequate access to water, drainage, and sanitation facilities (transmission of the above mentioned vector- and waterborne diseases).

Finally, there are also important combined effects of climate change and erosion to be expected on fishery and trade activities on Lake Tanganyika. Fisheries in Burundi represents close to 30% of the total animal protein available in the national food supply, and in many areas it is of vital significance for local inhabitants. It is projected that the foreseen climate change will stratify Lake Tanganyika more, leading to hampering of internal nutrient replenishment in surface waters with associated reduction in fish catches, while the Government of Burundi aims at an increase of 20%[10]. Also, the increased Rusizi sediment input in the lake hampers the spawning areas of fish species. Furthermore, the effects are indirect, e.g. if the port of Bujumbura cannot be reached (due to climate change causing lowered lake levels) then

[6] Van Beek et al., 2013. Analysis of climate adaptation in Burundi.

[7] Int. Federation of Red Cross and Red Crescent Societies, 2007. Burundi: the lakes are disappearing. Case study on climate change – Eastern Africa zone 2007. 5 pp.

[8] Van Beek et al., 2013. Analysis of climate adaptation in Burundi.

[9] World Bank, 2013. Turn down the heat – Climate Extremes, Regional Impacts, and the Case for Resilience. A Report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. 213 pp.

[10] République du Burundi, 2011. Plan national d'investissement Agricole (PNIA) 2012 – 2017. 93 pp.

some major regional trade lines are cut off. This has detrimental impacts on coffee and fish export, and all other food import as well.

As a consequence, poverty in the region may grow even further due to climate impacts as poor households with climate sensitive sources of income are often disproportionately affected by climate change and large parts of the population still depend on the agricultural sector as their primary source of food security and income.[11] Furthermore, gender disparities may increase as a consequence of the larger impact that food, water and fuel availability and quality, and sanitation and water borne diseases generally have on women.

For more details about context information, reference is made to Annex1.

3. RECOMMENDATIONS FOR INTEGRATION

The following are general recommendations at different levels of scale and entry points for integrating environment, climate change and disaster risk reduction.

3.1 Strengthening the resource base – farm level

Key to sustainability of food security is to improve the resource base, being soils and water supply, in a gender sensitive manner. This implies that the soils enabling the envisaged production must have the required qualities, i.e. the right structure (water holding capacity) and fertility[12]. The measures required to do so link up with a range of integrated soil and water management and climate smart techniques that are also part of the package of sustainable intensification, i.e. increasing productivity with more efficient use of inputs and with less environmental impact. This can be done in collaboration with the planned Centre National d'Innovation Technique[13].

Some examples are:

- Integrated water management to enhance efficiency of water use, both in rain-fed and irrigated systems, e.g. in rice (contributing to improved yields and also for reduced methane emissions);
- Various ways of integrating the role of woody perennials on farmlands, e.g. as windbreaks, woodlots, buffer strips, agro-forestry systems, also enhancing erosion control;
- Integrated pest, disease and weed management – this will become even more important as a way of adaptation to climate change if this alters patterns of pests and diseases;

[11] World Bank, 2013. Turn down the heat – Climate Extremes, Regional Impacts, and the Case for Resilience. A Report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics. 213 pp.

[12] République du Burundi, 2011. Plan national d'investissement Agricole (PNIA) 2012 – 2017. 93 pp.

[13] République du Burundi, 2013. Stratégie Nationale et Plan d'actions sur le changement climatique: p. 42.

- Restoring degraded soils through soil and water conservation measures, for rehabilitation and stabilization, e.g. contour ploughing and bunds. This work is already carried out in Rwanda.
- Improvement of soil fertility through Integrated Soil Fertility Management (ISFM)[14] with optimal use of a mix of organic and inorganic fertility inputs that also enhances carbon storage.

In view of the different roles of women and men in resource management (e.g. water, pest, disease, weed management) related to food security, gender aspects should be assessed before deciding on measures to be taken to ensure no unwarranted negative impact on gender equality.

3.2 Protecting areas with important ecosystem services – landscape level

At *landscape level*, it is important to set limitations to agricultural expansion (into sensitive areas such as wetlands and forest) and priorities for rehabilitation of degraded land (of areas with important environmental services). There are also important linkages between agricultural land use, erosion and the viability of Lake Tanganyika and its fish production. These linkages will only become more important in the scope of climate change. Measures are needed to set local priorities (e.g. at provincial level) in terms of soil protection and limits to further expansion of agricultural land. This requires land use planning, which is a complex subject, probably little developed in Burundi. Both a bottom-up approach (identifying farmland areas to be protected – strips, buffer zones, slopes) and a top-down approach (identifying areas with key ecosystem services to be protected) are required. A participatory approach is required that specifically engages women (organizations). The ongoing decentralization process can be an opportunity to initiate land use planning processes. For areas that will be protected it may be possible to acquire REDD+ funds (although this has so far hardly been realized in practice and funds remain limited).

There are important linkages between agricultural land use, erosion and the viability of fish production, for example in Lake Tanganyika. As an example of regional implications: in the Lukaga, DRC, there are initial plans to setup a barrage to regulate the lake level. There are several impact scenarios modelled. One includes the impact on shore-communities by lake levels 4 meters higher than current level. If this happens a great deal of Bujumbura including the lower Rusizi planes and park as well as a Bujumbura municipal waste site will inundate. This illustrates the need for Integrated Water Resources Management (including land use planning) with the various stakeholders[15].

[14] Fairhurst, T. (Ed.), 2012. Africa Soil Health Consortium: Handbook for Integrated Soil Fertility Management. CAB.

[15] The Dutch have special knowledge on combining IWRM with soft and green engineering practices. Advantages by local African proof techniques to improve water retention and counterbalance erosion will directly lead to improvement on ecosystem services provision in the basins (including wild life too). Netherlands is strong on green adaptation techniques that mitigate unpredicted water flows and risks. Techniques that can be applied

3.3 Social and environmental sustainability in value chains

In terms of market development, in the selection of value chains to be supported, there is need to pay attention to environmental and social sustainability and gender issues. These do not only pose risks (there are checklists available to assess sustainability risks per value chain) but also opportunities as nowadays for many crops there are voluntary sustainability standards (VSS) available which can help producers (men and women) to increase production in a sustainable way. This is the case for most crops for which Burundi is said to have a competitive advantage: tea (Rainforest Alliance, successful in Kenya), coffee (e.g. UTZ, successful in Kenya and Uganda), cotton (Better Cotton Initiative, BCI) and rice (Sustainable Rice Platform). It has been demonstrated that these initiatives can enhance access to markets and higher net incomes for producers, while also ensuring compliance to environmental and social sustainability norms[16]. There are also important linkages to climate change, like reduction of the use of firewood, charcoal and peat, e.g. by promoting cooking on basis of solar energy[17], and increased efficiency of charcoal making (as being done in Rwanda). This has an additional positive effect on women, who are the main users of fuel in the house. The current winning of peat is questioned because it strongly increases GHG emissions (and thus being counterproductive to other measures proposed in the MASP). The DSU, therefore, would promote use of renewable energy. The above standards also stimulate application of good agricultural practices (GAPs) and provide training of producers on these techniques. Some private companies would be keen to pick this up.

3.4 Investment in infrastructure

New actions that could be considered to strengthen the MASP are:

- To reduce methane emissions directly from sewage water plants, a biogas installation at the sewage water plant in Bujumbura could be considered. In addition, the electricity generated reduces the need for electricity from diesel generators[18] (thus less CO_2 emission). This required an upgrade of the current sewage plant up (GIZ is upgrading it, or planned to do so). Additional benefit: no more sewage release in the lake (reduction of sedimentation) and nutrients can be used as inputs in agriculture.
- Measures for companies to reduce emission and waste, and generate electricity with solar panels (some are Dutch companies).
- With the forecasted reduction in rainfall, water conservation and water harvesting techniques (e.g. from the house roofs) for drinking water and small plot watering (especially for women who are usually responsible for fetching water and cultivate vegetables, cereals for the children and specific cash crops) should be investigated.

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also for urban areas and coastal developments around the lake with insufficient water management, but where high property value is situated.

[16] Recent research carried out by Aidenvironment for IFC and DGIS on the uptake of Voluntary Sustainability Standards.

[17] http://www.solarcooking.nl/?t=3 (seen on 18/8)

[18] http://www.engineeringnews.co.za/article/by-product-potential-2012-08-31 (seen on 18/8)

- With increased risks for flooding investment in infrastructure that prevents and manages floods (e.g. watershed management and land sliding prevention measures) is recommended.

3.5 Capacity building Agricultural and Environmental R&D

In terms of capacity building, important requirements are the improved skills of farmers in terms of adopting and applying good agricultural practices (GAP, especially more sustainable and climate-smart farming techniques, such as mentioned above). Particular attention may need to be given to women, to close the capacity, education and literacy gap. Secondly, it is important that capacities are developed for sustainable land use planning, among decentralized authorities responsible for planning issues. This will require improved collaboration between staff of the Ministry of Agriculture & Livestock (MINAGRIE) and the Ministry of Environment (MINATE). Another condition for sustainable land use is land tenure security, a subject already covered by the EKN programme.

4. RECOMMENDATIONS FOR THE MASP 2012-2015

The current MASP 2012-2015 was reviewed in light of the proposed integration measures (previous chapter), leading to the following specific recommendations.

MASP Section 3.1

A paragraph on climate change with associated effects, including those related to gender, should be incorporated (and summarized into a one liner in Table 1 above 'high population density'); degree of severity of possible effects (e.g. degradation of soils) varies largely per province; also mention the high dependency on fuel wood as energy source. Table 1 should mention as a solution not only productivity increase, but also refer to the proposed measures at farm and landscape level (improved land and water use).

MASP Section 3.3

The MASP states that there are uncertainties in executing the PNIA, i.e. to promote and reinforce the 15 agricultural value chains (p. 9). Five essential elements or factors of a favourable business environment are mentioned (p. 10), but the resource base of it all, i.e. sufficient land of good quality (structure and fertility) and favourable climatic conditions and its gender dimension are not specified. The recent report by the government of Burundi[19] makes it clear that reversing soil degradation is key to any development. Hence, it is recommended to specifically mention as a transversal or crosscutting theme in the MASP: **The ecological and agricultural production resource base at local and macro (landscape) level** (in a similar way as gender).

MASP Section 4.2 (and possibly related context analysis 3.3)

[19] République du Burundi, 2013. Stratégie Nationale et Plan d'actions sur le changement climatique, 100 pp.

A fifth argument for the geographical focus (p. 16) could be: Cibitoke and Bubanza are provinces where droughts may occur more often in the near future due to climate change. To a certain extent this also holds for Bujumbura Rural. These provinces have also a high degree of land sliding and de-gradation index[20].

'Value chain approach and private sector development' (p. 16): in the choice of product value chains to be promoted, there is need to include sustainability criteria (including climate smart techniques and gender aspects) in terms of risks/impacts and in terms of potentials for linkages to voluntary sustainability standards (e.g. tea, coffee, rice).

'Follow national policy' (p. 17) in relation to climate change[21] means to place more focus on restoring degraded land and in the meantime anticipate on the expected climate changes (climate smart techniques).

Many of the below suggestions relate to the proposed emphasis on "The ecological and agricultural production resource base at local and macro (landscape) level" as a transversal theme in the five entry points for analysing a favourable (agri-)business environment.

'Law and regulation: access to land': would it be an idea to link access to land to a (to be defined) degree of adopting sustainable land use? Also to be mentioned here is the subject of respecting boundaries to the remaining wetlands and forested lands, being important from a sustainable production and security point of view (and becoming more important in view of climate change). Here, the need for spatial planning (local land use planning) may come in. The absence of a gender sensitive land law is important to take into account.

'Access to markets' (p. 18): why does the MASP not pay attention to the crops for which Burundi is stated to have comparative advantages, being tea, coffee (possibly rice). These crops also offer good potentials for local processing and business opportunities, and using voluntary sustainability standards (VSS) with increased access to markets. This paragraph leaves out the consequences of climate change, i.e. other products coming on the markets and the need for inputs related to climate smart techniques. Additional inputs for water harvesting techniques (for areas with expected lower rainfall) should also be considered.

'Access to financial services and business development services': attention should also be paid to credits for climate smart techniques. Note that the new projects 'Fanning the Spark' and 'Insured Growth' (Achmea, Alterra, ZOA, HealthnetTPO) work on this theme. Financial services (and on-site training, see below) are important for farmers to adopt certain GAP/climate-smart measures and should ensure equal access for men and women. Note that many VSS have experience in making these linkages and delivering financial support schemes and extension services. In addition, there are experiences in financial schemes for rehabilitation of degraded lands, which potentially could also include REDD+ funds. These linkages need to be developed for effective up-scaling of these techniques.

[20] République du Burundi, 2013. Stratégie Nationale et Plan d'actions sur le changement climatique (p. 7 and 10).

[21] '*L'objectif de la stratégie sur le changement climatique est de renforcer les capacités et la résilience du Burundi pour faire face aux défis du changement climatique' p. xi in #19.*

'Infrastructure': after recent approval of the funding of the Rusumo hydropower plant (13/8/13) there is some turmoil about the possible disasters: destruction of natural ecosystems and agricultural land, forced resettlement, and effects on water flows for other hydropower dams[22]. The DSU recommends that EKN monitor the negative effects and supports mitigating measures. In addition, it is recommend to include here also the work on degraded lands and the degradation prevention work (i.e. anti-erosion measures) in a similar set up as the work on irrigation schemes. Finally, it is suggested to investigate possible investment (with other donors) in a biogas from sewage water installation in Bujumbura (resulting in reduction of valuable nutrients lost into the lake and more electricity available).

'Access to technology and knowledge': new similar type projects started recently, but in different provinces. Hence, the DSU recommends that EKN plays an active role in linking the various projects to increase up-scaling (impact). Once again, for up-scaling financial support services and extension support services (training) are key factors.

'Support capacity building and sector based approach': increase the urge to transform the agricultural sector due to climate change. Reinforcement of e.g. ISABU and DPAE staff through applied research and scientific programmes on climate change with the mentioned Dutch organizations could be another action.

5. RECOMMENDATIONS FOR THE BEMO'S

The DSU is aware that the current BEMO's are approved on-going projects. Nevertheless, if improved reporting on the integration of environment, climate change and disaster risk reduction is aimed at, each project could be asked to provide additional values for the indicators (Chapter 6) to the extent they can deliver within the constraints of that project. A detailed screening of the project and a discussion could be beneficial to determine the possibilities.

Project FARN Nutrition. There may be opportunities to link nutrition and school feeding programmes to a supply of locally produced food crops with a preference to those farmers that apply (*to be defined*) climate-smart and sustainable agricultural practices. There is also scope for linking these programmes to education about climate change and the required adaptation ('Green clubs'). In addition, the link to fisheries from Lake Tanganyika (protein supply) that will be threatened by climate change and land erosion should be made.

PAM. There should be opportunities to link the Purchase for Progress (P4P) programme stimulating smallholder farmers producing for PAM food supply market, with farmers that apply (*to be defined*) climate-smart and sustainable agricultural practices. As part of the commercial approach the DSU recommends to include in the '*appel d'offre'* for supplying farmers criteria on application of climate-smart and sustainable agricultural practices and encourage participation of female farmers.

[22] http://ens-newswire.com/2013/08/13/world-bank-funds-hydro-dam-for-africas-great-lakes-region/ (seen on 15/8/2013)

Basketfund PNSEB. The BEMO notes the relation with ecological sustainability and climate change, but it is important to know how this is worked out in practice. There is reference to 'good practices' of using fertilizer, but these vary largely per crop and per soil type. Why not link up to the PANPNSEB IFDC approach or the Fanning the Spark project that adopts an integrated and sustainable approach of which fertilizers are part?

PANPNSEB IFDC. The project takes into account sustainability and climate risk related issues as part of an integrated approach. Two additional suggestions are (i) to focus the project at farmers growing crop value chains that have good sustainability scores, and (ii) to link up the project to spatial planning initiatives (in order to avoid that farmers benefitting from fertilizers expand their farmland area and/or to prioritize the project in areas with high risk of erosion and floods and associated disasters). It is not clear whether the presence of soil conservation measures are used as a *condition* for receiving fertilizers (as the DSU would recommend). There is also a good link possible to the land tenure project by prioritizing farmers with secured land ownership (see below). Particular measures should be taken to involve women and secure their land rights. Finally, climate smart techniques should be part and parcel of this programme.

BEMODCC: Without doubt, land tenure security stimulates investments in sustainable land use. However, to what extent does this project indeed stimulate this follow-up? This could be done by linkages to the above IFDC project or by allowing access to micro-credits for sustainable land use investments (climate smart investments or land rehabilitation including the important anti-erosion measures) under the condition of secure land ownership.

6. INDICATORS

This advice provides preliminary suggestions for indicators, for the embassy to monitor and report on DGIS requirements regarding environment, climate change and disaster risk reduction. This advice has so far been based on the provided documentation i.e. the MASP, the BEMO's, the result chains of EKNs, the result matrix on Food security and the DME memo on water[23]. Rio Markers are used by DGIS to evaluate project proposals to be fundable as climate change adaptation and mitigation programmes[24]. The DSU proposes indicators that are logically derived from the Rio Markers to allow current and future programs to be monitored and evaluated on similar criteria. The generic indicators proposed below integrate environment, climate change and disaster risk reduction (Table 1). Some of the listed indicators will also be proposed for the regional MASP, so that results can be compared and aggregated, and the relative contribution of each MASP can be assessed (something the DSU recommends strongly is to asses and report on the impact of the EKN Programmes also at higher levels of scales to show relevance and impact). The cross-comparison may also show certain gaps or opportunities for future activities.

[23] DME -Water unit memo on water resource management indicators of 22 Jn. 2013

[24] OECD, 2011. Handbook on the OECD-DAC Climate Markers

The eligibility criteria of the OECD/DAC state that the contribution should be verifiable through the provided documentation. The current assessment of the Rio Markers is based on the BEMO's so it might be possible that specific M&E reports provide more information. Some projects already include relevant activities but these may need to be adjusted if more specific project documentation becomes available.

In Table 1 the DSU has made a distinction between household level indicators and macro (sub-national, national or regional) level indicators. Remaining questions that still need to be answered are (i) how can the proposed indicators be specifically measured, and (ii) who will be responsible to do so, will this be the EKN and/or the projects funded by the EKN? On the question of responsibility, there are different options for the EKN, which differ for the household and macro level indicators:

- 'Do nothing': Already approved projects go on as defined and do not include activities to monitor the proposed indicators, nor will additional activities be defined (beyond the projects) to collect such information (e.g. by national institutes). While some projects conduct activities with a certain relation to the proposed indicators, other do not. The EKN reports to DGIS based upon the M&E reports submitted by the projects and thus does not fully address the various climate change and environment concerns raised and reduce the potential role that the EKN's can play at the different levels of influence.
- 'Integrate': In case this option is chosen, EKN has the following options:
    - On household level indicators, the options are to ask relevant projects (i) to integrate monitoring of the proposed household level indicators in their M&E system (for example report on soil conservation measures disaggregated by gender), or (ii) projects request a (local) consultant to carry out a survey on the proposed indicators (baseline + survey after some years);
    - On macro level indicators, it is not realistic to expect that projects collect these data, so the options would be (i) to support a scientific institute to collect relevant data (if not available) and provide capacity support to these institutes to do this in a reliable manner, or (ii) to request a consultant to gather available date and aggregate and analyse the data at one moment in time.
    - Note that in most cases macro level indicators will need some sort of ground-level verification whereby local-level surveys will be required. Also, aggregation of household level data collection will generate insight in macro level data.

Table 1. Potential primary Indicators.

Purpose: to monitor and report on sustainability – climate change, environment and disaster risk reduction – on macro-level (relates to the outcome level of the result chain) and on household/project level (to improve on-going activities). This relates to 'sustainable and inclusive growth' ('Wat de wereld verdient', 2013) and the targets/result areas of the result chains of the MASP. EKN is expected to annually report on the overall outcome and its sustainability component and Rio Markers, to inform DDE, DME, and IOB on the contribution by EKN to the spearheads (and provide input on the response to the Motie Ferrier).

Entry points: spearhead Food Security and their underlying activities.

Subject	Level	Indicator	Unit	Link to targets / result areas:	Source of information[1]
Macro (sub-national / provincial, national or regional) level					
Environment and water	Macro and regional	Area of ecosystems – agricultural lands, forest areas, natural areas, water catchments- under a sustainable management / IWRM regime.	Ha or km^2 , # sustainability or IWRM plans	'Ensure environmental sustainability'	National and/or regional statistics
Environment, food security and trade	Macro	Traded volume of selected agricultural value chains which integrate sustainability and gender based on sustainability standards.	Metric tonnes, number of producers and % total	'More efficient markets and improved business climate'	National and/or regional statistics (based on household surveys)
Water and food security	Macro	Proportion of total water resources used for agriculture (agricultural water productivity)	Total liters, Liters/ha per value chain	'Increase in sustainable food production'	National and/or regional statistics
Climate change and environment	Macro and regional	Area of national and cross-boundary ecosystems with important resilience services and sinks and reservoirs of GHGs: managed forest and other ecosystems, afforestation, reforestation, and restoration of degraded land	Ha or km^2	'Ensure environmental sustainability'	National and/or regional statistics

Climate change, DRR and environment	Macro	Number of administrative units that adopt a process of developing local spatial land use plans that take into account limitations of cropland expansion, priorities for erosion control, and for rehabilitation of degraded lands	Number	'Increase in sustainable food production' and 'Ensure environmental sustainability'	National planning departments
Climate Change and DRR	Macro	Surface area of national food insecure regions.	Ha or km^2	'Increase in sustainable food production'	National and/or regional statistics
Household level (if possible gender disaggregated)					
Environment, food security and trade	Household	Farmers that integrate sustainability and gender in selected agricultural value chains which are based on sustainability standards.	Number, % of producers	'More efficient markets and improved business climate'	Project or local partner
Environment, climate change and food security	Household	Farmers that have been trained on good agricultural practices (GAP), especially more sustainable farming techniques and climate smart cropping systems	Number, % of farmers	'More efficient markets and improved business climate'	Project or local partner
Water and food security	Household	Number farmers that increase water productivity in relation to agricultural yield / ha , e.g. for the selected value chains.	Number of farmers, Liters/ha	'Increase in sustainable food production'	Project or local partner
Climate Change and DRR	Household	Farmers adopting climate-smart and sustainable agricultural practices (e.g. resistant species, anti-erosion measures, water saving irrigation), or area with such measures applied	Number of farmers, Ha or km^2	'More efficient markets and improved business climate'	Project or local partner
Climate Change and DRR	Household	Property (houses, fields) destroyed through flooding, land sliding, etc. in the region	Ha or km^2 or US$	'Ensure environmental sustainability'	

[1] Sources of information depend on the level of integration of MASP supported activities into the national programmes. Possible sources are reports from different ministries and sub-national institutes, and Dutch projects. On project-level, sources are reports preferably from existing partnerships or collaboration projects. It is also possible that another projects conducts these activities and thus their M&E reports would be used.

The results of the above proposed indicators will be combined with the following existing indicators as already used by EKN[25] and the Government of Burundi[26] (note: the DSU left out indicators related to other spearheads such as safety, health and food]:

- Agricultural GDP of Burundi [million US$]
- Part of Agricultural GDP sold on markets [%]
- Volume of export of agricultural commodities [million US$]
- Variability in yields over a multi-year period
- Variability in income over a multi-year period
- Share of population with improved livelihoods (e.g, variability in yields and/or income over a multi-year period)
- Average household income of small farmers (preferably disaggregated by male/female HH) [US$]
- Farmers with increased income through NL funded activities [number]
- Rate of increase in income derived from program activities [%]
- Share of rural population with access to credit (men/women) [%]
- Financial inclusion rate [%]
- Access to micro-credits (subdivided for climate smart techniques) [numbers]
- Access to micro-insurance (subdivided for climate change risks) [number]
- Number of farmers below subsistence farming (poverty alleviation is important in MASP)

[25] Results_BUJ_FoodSecurity 2012_june2013.xls

[26] République du Burundi, 2011. Plan national d'investissement Agricole (PNIA) 2012 – 2017. 93 pp.

Annex 1. Background and detailed information including references

Additional information on the context of Burundi

From an environmental, development and security point of view, the critical ecosystems in Burundi are the lowland wetlands, the upland forests and hill slopes. The wetlands or marshes (*marais*) are a valuable resource to Burundi for their ecological products and services. Services include water table recharge and flood control, both are important services for sustaining food production in the plains and for security of people. Wetlands also produce peat (a fuel alternative to firewood) and clay (for housing construction and brick-making). The wetlands are also important as a habitat for biodiversity (birds, fish, antelopes). Burundi therefore currently has 4 protected Ramsar sites, with a total area of 78,515 ha. Most wetlands are located in the north eastern part of the country and major proportions have been cultivated.[27] Wetlands are threatened by clearing for agriculture, erosion and over-exploitation of their natural resources.

About 7% or 172,000 ha of Burundi is forested, of which 23% is primary forest, being the most bio-diverse and carbon dense form of forest. Forests in Burundi provide important ecosystem services, especially soil protection, erosion control and watershed protection, which is important for provision of water and stabilization of agricultural croplands. Forests provide fuel wood and various timber and non-timber forest products, such as bamboo and nutritional foods. Burundi's forests are also areas of highest biomass carbon density, containing 12% of the country's biomass carbon while covering only 3% of its land area.[28] These are also areas with high biodiversity. Between 1990 and 2010, forest loss in Burundi was an average of 5,850 ha or 2.02% per year (41% lost between 1990 and 2010).[29] The causes are clearing for agricultural expansion, degradation by cutting and fires. Reduction of forest coverage has contributed to more erosion and degradation of croplands.

In the EKN intervention area there is a Ramsar site (Rusizi national park) and a protected forest upland area (Kibira national park). Rusizi national park is threatened by erosion, over-exploitation of natural resources, and the use of fertilizers and pesticides for agriculture[30]. There are also invasive macrophytes like water ferns and water hyacinth. What is lacking is an IWRM Plan. Its hydrology depends on upper Rusizi flow control but also lower Tanganyika lake level. Kibira national park (linked to the Nyungwe park in Rwanda) is threatened by felling of trees and cutting of bamboo, fire and poaching, and encroaching subsistence agriculture. The water from the forests of the Kibira National Park account for over three-quarters of the water that goes into the country's largest dam, which generates half of hydroelectric energy generated in the country[31]. The map on vulnerability of the land to climate change shows that the EKN intervention area has the highest (very high) risk of soil

[27] http://www.fao.org/docrep/003/x6611e/x6611e02.htm (seen 16-08-2013)

[28] Carbon, biodiversity & ecosystem services: exploring co-benefits. http://www.carbon-biodiversity.net/Content/ShortProfiles/Burundi%20Profile%20110408_final.pdf

[29] http://rainforests.mongabay.com/20burundi.htm

[30] The Annotated Ramsar List of Wetlands of International Importance: Burundi. http://www.ramsar.org/cda/en/ramsar-pubs-notes-anno-burundi/main/ramsar/1-30-168%5E16691_4000_0__

[31] Ten year transboundary plan (2009-2018) Nyungwe - Kibira Landscape, 2009. Supported by Wildlife Conservation Society.

movement, which underlines the importance of managing the sloping lands (forested or agricultural, many of which are degraded)[32].

Indirect effects of climate change on food security (to be worked out later in detail) occur through the reduction of labour availability in food production (farming, processing, selling, etc.) due to 1) shortage of groundwater (more time needed to get drinking water), 2) increase of insect borne diseases (e.g. more malaria in higher altitude areas due to the raise in temperature), and 3) flooding of swamps and lower areas (more epidemic diseases, such as cholera and dysentery, and malaria) and 4) gender related roles and differences. In addition, heat extremes and increased mean temperatures can reduce labour productivity, thereby undermining adaptive capacity and making it more difficult for economic and social development goals to be achieved[33].

There are important effects to be expected from climate change on fisheries. Fisheries in Burundi contributes only an estimated 1% to the country's agricultural GDP and 0.5% to its global GDP. Although these figures suggest that fisheries play but a minor role in the national economy, their significance as a source of food and, particularly along the Tanganyika lakeshore, as a source of employment, is very substantial. Fish represents close to 30% of the total animal protein available in the national food supply, and in many areas it is of vital significance for the nourishment, and indeed survival, of local inhabitants. First of all, the projected climate change will stratify Lake Tanganyika more, hamper internal nutrient replenishment for production surface waters and this is likely leading to reduced fish catches. Also, the increased Rusizi sediment input in the lake hampers the spawning areas of economically important fish species further.

Finally, it is noted that an international supported action by Lake Tanganyika Authority works on the protection of biodiversity and Sustainable Management of Natural Resources in the greater Lake Tanganyika[34].

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In addition to the documents provided by the RNE in Burundi, the following sources have been used.

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[32] Van Beek et al., 2013. Analysis of climate adaptation in Burundi. WUR

[33] World Bank, 2013. Turn down the heat – Climate Extremes, Regional Impacts, and the Case for Resilience. A Report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics: p. 54.

[34] http://lta.iwlearn.org/

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