DRAFT POLLINATION MANAGEMENT PLAN FOR KILIMAMBOGO SITE, KENYA

"CONSERVATION AND MANAGEMENT OF POLLINATORS FOR SUSTAINABLE AGRICULTURE, THROUGH AN ECOSYSTEM APPROACH"

GEF/UNEP/FAO PROJECT
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ROME, ITALY

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Introduction

The GEF/UNEP/FAO project, "Conservation and Management of Pollinators for Sustainable Agriculture, through an Ecosystem Approach" aims to build local, national, regional and global capacities among farmers, the agricultural research and extension community, and policy-makers to design and implementation of management practices that secure the pollination services of wild pollinators for horticultural crop production. The primary focus of this effort is on the development of pollination management plans for priority cropping systems with a high dependence on pollinators, and which also have important links to human livelihood and sustainable development, in selected STEP (Study, Training, Extension and Promotion) sites.

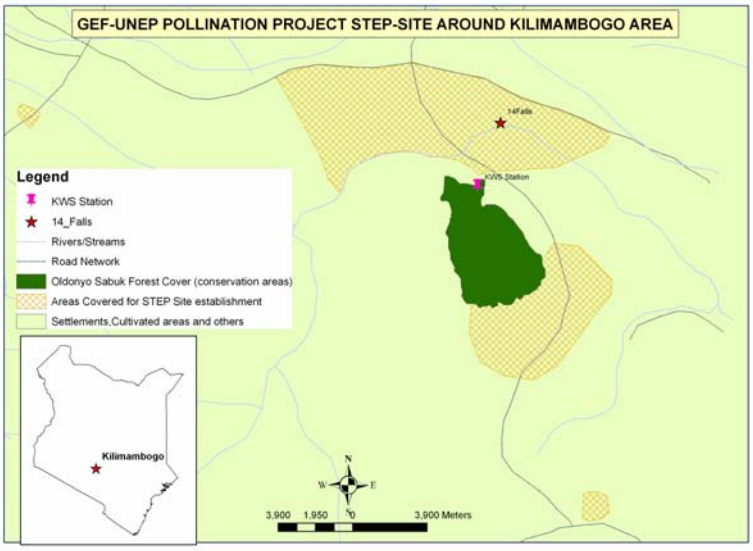
Inputs into the Draft Pollination Management Plan

The Kilimambogo area of Kenya is one of the STEP sites in the project. A number of activities have been carried out in this site in 2010, as basic input into developing the first draft of a pollination management plan.

1. Delineation of the Site

Each site is intended to comprise a cropping system and its wider agro-ecosystem, including adjacent natural ecosystems. In most cases, actual demonstration sites where practices will be tested will be located on farmers' land, and good pollination practices will be identified and applied in a participatory manner that responds to and respects farmers' livelihood needs.

The National Museums of Kenya have worked with local partners, including SACDEP (Sustainable Agriculture and Community Development) in Thika, to delineate the following areas as the Kilimambogo STEP Site:



2. Characterisation of current production systems, practices and main perceived needs for improvement.

Kilimambogo Site occurs at the border of Kenya's Central/Eastern province in Ol Donyo Sabuk Township. Thika town is the nearest town, about 20 kilometers from the edge of the site.

The Ol Donyo Sabuk Township is a natural ecosystem with a national park surrounded by marginal small-scale dryland farmlands. Ol Donyo Sabuk National Park is owned by the Kenyan government; this was formerly the sisal estate and cattle ranch of Lord Delamere that has been partly protected, and partly sub-divided into small-scale farms. Many of the former farm workers on the large estate have settled in the region, making the area highly diverse in terms of ethnicity. Land rights have not been well established, even for families farming land for over twenty years; however, with Kenya's 2010 constitution this may be resolved in the near future.

A mixed cropping system prevails in the Kilimambogo area. Maize, with legumes (green beans and other legumes such as pigeon pea) are the most common food crops, along with fruit crops of mangoes, papaya, and avocado, and some coffee plantations.

Pigeon peas are an important crop for domestic consumption, and for food security in the region. Green beans, grown for the domestic market and export, figure increasingly greater in Kenya's economy:

Main Exports of Agricultural Products
FAO Statistics

	2002	**2003**	**2004**	**2002**	**2003**	**2004**
	1000 tonnes			million US$		
EXPORTS						
Agricultural Products, Total				**563.1**	**1 291.3**	**1 296.0**

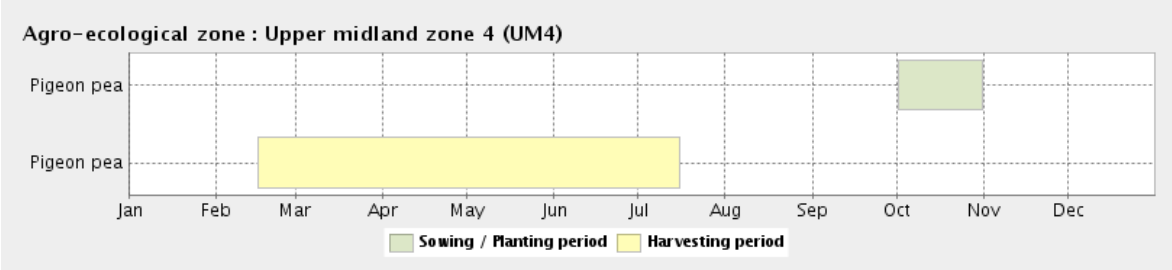
Tea	88.3	293.8	284.3	140.9	481.5	463.7
Crude organic materials NES	...	...	...	131.8	241.5	279.1
Coffee, green	16.7	63.1	48.6	35.1	90.0	87.8
Beans, green	18.0	27.2	32.6	38.2	61.6	85.2

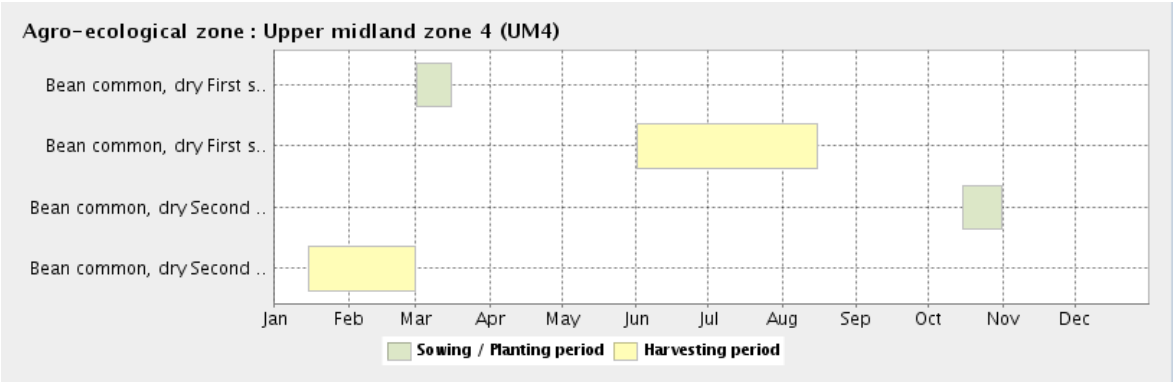
Natural areas are interspersed with agricultural areas, throughout the site. The Ol Donyo Sabuk National Park forms part of the vast Kilimambogo ecosystem covering an area of 60 km2. Many of small-scale farmers in the Kilimambogo area have defined their borders with fences and an uncultivated area next to the borders that make natural corridors.

Current production constraints for this cropping system

Unreliable rainfall resulting in poor crop yields; almost all farmers mention lack of water, recurrent droughts, and concerns over climate change
Despite the fact that Athi River runs through this area, farmers do not use it for irrigation.
Farms are small ranging from less than 1/2 to about 5-10ha.
Farm inputs are rare due to low household income.
Though not far from Thika town, farmers have poor market access due to transport problems.
There is wildlife and human conflict, for example monkeys eat the farmer's produce.
Finding ways to more effectively Integrate livestock and small scale farming
Poor incomes

Crop calendars for the two main focal crops, pigeon pea and French beans, are as follows:





Source: http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/en/

3. **Surveys of existing good practices and profiles of farmers applying them will form a basis for the plan, upon which good pollination practices can be built.**

Farmers in the village of Kwosau (of the sublocation Kyeleni, division Kwanzavi) have been working with the local partner, SACDEP under co-founding provided in a pilot phase of the project in Kenya. Through this phase, a number of farmers have become quite aware of the importance of pollination. Some farmers have taken measures to conserve small areas of biodiversity on their land, amongst their crops, with the specific aim of providing habitat to pollinators; these small "biodiversity reserves" are dominated by indigenous trees such as *Combretum*.

These same farmers are working with a larger group of farmers to raise indigenous tree seedlings in a nursery, and plant these trees on the barren northwest flank of Ol Donyo Sabuk National

Park. This portion of the protected area has been severely deforested in the past. As the farmers say, "The hill is almost naked; we want to cloth it for rain and pollinators".

Acacia and *Croton* seedling nursery.

Northwest slope of Ol Donyo Sabuk National Park, where local farming communities have contributed indigenous tree seedlings and their labour to reforest the park, for the benefit of improved watershed and pollination services.

In Tala District on the eastern slope of Ol Donyo Sabuk, the project has worked with extension agents to identify farmer groups that cultivate pollinator-dependent crops and are interested in learning about pollination management. Farmers in this area cultivate pigeon pea, pumpkin, green beans, tomato, pili-pili, and fruit trees such as mangos, avocados and oranges, in addition to the staple crops such as maize. There are a number of self-help groups active in the district. Some of them, such as the Mwa na Kompya group (which can be understood as "Working Early in the Morning" or "A New Beginning") focus on widowed and elderly women and on orphans.

Members of the Mwa ya Kompya(?) Self-help Group

In the area where this group is active, there is practice of planting alleys of pigeon pea horizontally along slopes, to prevent soil erosion and restore soil fertility. Other crops such as maize are grown between the alleys.

Pigeon Pea Alley Cropping

4. Crop pollination needs and information on key pollinators (as drawn from literature and application of project protocols).

Insect pollination plays a critical role in increasing crop yields and improving plant hybrid vigour in Kenya. Kasina (2009a) estimated a value of 3.2 million U.S Dollars from the pollination services provided to 8 crops grown for vegetables in Kakamega district. Although some crops were self-pollinating, abundance and visitation by wild bees increased farm yields by a range of between 25-99%. Onim (1979) reported increase cross-pollination of Pigeon pea (*Cajanus cajan* L.) by up 94.5% due to high abundance of pollinators in semi-arid eastern Kenya. Species from the genera *Chalicodoma*, five *Megachile,* and five *Xylocopa* species were the major ones. Further, cross-pollen produced 22% more hybrid seeds per pod than self-pollen. Mean grain yield of improved cultivars on farmers fields was 2637kg/ha as compared with 1361kg/ha of farmers varieties. Small improvements in yield can have large positive impacts on profit and food security to the rural farmers.

Crop	**Flower visitors, documented in Kenya**	**References**
Pigeonpea (*Cajanus cajan* L.)	*Chalicodoma rufiventris* Guerin, *C. congruens natalensis* Friese, *C. bombiformis* Gerstaecker, *C. torrida torrida* Smith, *C. neavei* Vachal, *C. cincta combusts* Smith, *C. cincta nigrocincta* Ritsema, *C. bombiformis bombiformis* Gertaecker, *C. felina feline* Gerstaecker, *C. torrida pachingeri* Friese, *Megachile wahlbergi* Friese, *M. nasalis* Smith, *M. fulvitarsis* Friese, *M. apiformis* Smith, *M. bituberculata* Ritsema, *Xylocopa flavorufa* DeGeer, X. *inconstens* Smith, X. spec. *aff. calens* Lepeletier, X. *spec. aff. enderlein* Schulz, X. *aff. caffra* L., *Amegilla plumipes* Fabricius, *Apis mellifera adansoni* Ltr., *Crocisa* sp., *Lampides boeticus*	Onim 1980, Otieno (pers.comm.)
Cow pea	*Xylocopa flavorufa*	Pasquet et al.

Common bean (*Phaseolus vulgaris*)	*Apis mellifera, Xylocopa calens, Xylocopa incostans, Xylocopa flavorufa, Xylocopa* spp., *Xylocopa nigrita, Megachile* spp., *Amegilla* spp., *Ceratina* spp., Solitary bees	Kasina *et. al.* 2009
French bean (Phaseolus spp.)	(not known- studies underway through project?)	
Runner bean (*Vicia faba*)	(not known)	
Watermelon (*Citrullus lanatus* (Thunb.)	*Apis mellifera* L., *Xylocopa, Hypotrigona,*	Njoroge *et. al.* 2004
Pumpkin	(not known)	
Crotalaria (*Clotalaria* spp.)	(not known- studies underway)	
Spider plant (*Cleome gynadra* L.)	(not known)	
Papaya (*Carica papaya*)	*Hippotion celerio, Nephele comma, Agrius convolvuli*	Martins & Johnson 2009
Avocado (Persea americana)	(not known)	

5. **The resource needs of known pollinators of the target crop**

   Given that pigeon pea and other legumes are key target crops in this STEP site, the focus on resource needs will be on their main wild pollinators: Leaf cutter bees (Megachilids) and carpenter bees (*Xylocopa* spp.), and *Apis mellifera* which occurs both wild and as a managed pollinator.

One of the aims of the information gathering work in the Kilimambogo STEP site will be to gather specific information on leaf cutter and carpenter bees and what resources and management practices can best support them. We do not have this information yet; at best, we can borrow insights from studies. With respect to megachilids, Willmer & Stone suggest two management strategies to improve coffee yield in Papua New Guinea. Firstly, to create more nesting sites for ground-nesting bees, e.g. open soil on embankments, and secondly, to improve the availability of alternative flower resources such as weeds and hedgerow plants. In the light of findings in Central Sulawesi, Klein (2003) suggest similar local management strategies. To enhance solitary bees it is recommended there should be a reduction of shade and less intensive weed control, thereby supporting diverse herbaceous ground vegetation.

Carpenter bees are known to feed on nectar and pollen from a wide variety of flowers; a list from Brazil includes many families common in Kenya: Asteraceae, Bignoniaceae, Caesalpiniaceae, Fabaceae, Lamiaceae, Meliaceae and Verbenaceae. (Schlindwein C., 2003). Species native to Kenya have often been found visiting the common trailsde herb, *Justicia flava*. Carpenter bees nest in burrows in dead wood, that are excavated by themselves.

6. **The suite of good pollinator practices that can be applied to each agro-ecosystem to conserve and adaptively manage pollination services will be identified, implemented and documented.**

The participation of farmers and farmer communities will be central to the development of demonstration sites. It must be recognized, within each plan, that the proposed measures to conserve pollinators do not stand alone; they must be effectively integrated into existing farming systems and developed in an adaptive manner. Land managers will need to work with the challenges of their local ecology and develop management systems tailored to a specific site and farmers' competing uses of natural resources for sustainable livelihoods. The implications, feasibility and benefits of the practices for farmers and land managers also need consideration. Thus, evaluation of the plans will be an important part of the later development and plan revision.

The process as described in the Socio-Economic Protocol, of selecting particular practices to evaluate should be covered in the TOT, and then followed in the FFS with farming communities, so that the plan will reflect the practices that are of interest to the community to adopt, and those that they want to subject to focused farmer testing in a FFS format.

In presenting pollination management to trainers, trainees and/or farming communities, facilitator should use the information included in this draft management plan to inform the choice of practices that would be relevant to the needs of the crop and the known pollinators. In this respect, Box 1 of the Socio-Economic Protocol has been revised, as below, to focus on practices that would be relevant in Kilimambogo, to sustaining populations of leaf-cutter bees and carpenter bees that are known to pollinate pigeon pea and French beans, along with honeybees that may be managed or feral.

Box 1 Pollinator-friendly practices (those specifically relevant to this site/focal crops)

Forage for pollinators
Mixed crop types over a growing season to reduce or eliminate dearth period with no crops in flower
Mixed crop types within a field to attract pollinators
Mix of crop varieties to extend the foraging period
Patches of non-crop vegetation, flower-rich field margins, buffer zones and permanent hedgerows*
No-till agriculture (for legume forage)
At landscape scale conservation of natural and semi-natural habitat providing pollen sources for pollinators
Reduce use of chemicals
Use of less toxic pesticides and better application procedures
Managing for bee nest sites
No till agriculture (so as not to disturb soil-nesting bees)
Leave dead trees and branches standing
Leave patches of bare ground undisturbed

Additionally practices which could be relevant to the challenges of the Kilimambogo site might include, and might be considered by training groups:

Introduction of soil management techniques such as composting to help hold water better; these may assist in helping the agroecosystem sustain more vegetation that benefits pollinators.

Introduction of small-scale water harvesting structures, to address issues of drought and climate change; this may provide water as well to pollinators that may be limiting their populations. Integration of plant varieties that both prolong forage for pollinators, and provide some resilience against climate change

Next Steps

The next steps in the Kilimambogo site will be to present this draft pollination management plan in the context of training of trainers, and training of farmers, as well as other meetings with community groups in the Kilimambogo area, to carry on with the participatory procedures as outlined in the draft socio-economic protocol, specifically to:

- Identify relevant and possible pollinator-friendly practices for a specific site, and discuss their implications (as per page 5 of the protocol)
- Explore implications of selected practice(s) with farmers (as per page 13 of the protocol)
- Select the plots where the Pollinator-friendly practices will be tested(as per page 14 of the protocol)
- Select indicators and determine how they will be recorded and tracked (as per page 15 of the protocol)
- Collect and analyze farmer's data on cost and benefits of practices (as per page 25 of the protocol).
- Incorporate findings (from all of these steps in an annually revised draft management plan, as adopted by the community.

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