Malaria prevalence in the African highlands ranges hypo to hyper-endemic. Unlike in the lowlands where up >50-90% of the population are infected, 10-50% of the people in the highlands may be infected and many have low immunity to the disease. Where prevalence is less than 10% transmission is considered unstable and prone to epidemics. Malaria is considered as the most climate sensitive vector borne disease. The highlands in the East Africa regions are areas above 1500 meters above sea level where the mean temperature varies between 18-21 °C. In Western Kenya the mean annual rainfall in the highlands is about 2000mm. The complex ecology of the highlands comprises valleys, numerous streams, major rivers, hills and plateaus. These topographic characteristics affect drainage and breeding of malaria vectors and thus the stability of transmission.

Since 1988 epidemic malaria spread from 3 to 15 districts particularly in the early 1990’s. The biggest malaria epidemics were observed during the 1997/98 El Nino. Analysis of hospital derived malaria data indicated that most of the epidemics occurred during El Nino years which are wetter and warmer than normal.

Malaria transmission in general may have increased in the highlands as a result of land use change such as swamp reclamation and deforestation. Deforestation was shown to increase the mean local temperature by 1.8°C and swamp reclamation increased temperatures in breeding habitats by 0.8°C. The implication of these changes is reduced time for larval and parasite development in the female vectors which results in enhanced transmission.

In the last two decades malaria parasites have developed resistance to cheap effective and safe drugs such as chloroquine and sulfadoxine pyrimethamine. The cost of new artemisinin based drugs is a major barrier to their wide use. The cost of insecticide treated bed nets has also prevented their use by the majority of the populations.

We have carried out studies in the highlands of western Kenya to determine how land use change has affected malaria transmission. We established the spatial temporal dynamics of larval and adult vector stages and parasite prevalence. Survival experiments were carried out to determine the effects of microclimate change due to land use change on adult vector and larvae. Malaria transmission was shown to be focal and most intense in valley bottoms. Using this information we have tested vector control strategies that have the potential to reduce the operational costs by 50-75% of the traditional approaches.