

**Madeleine Thomson, Ph.D.**  
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#### Background

Madeleine Thomson trained originally as a field entomologist. She spent three years in Sierra Leone undertaking operational research on onchocerciasis for the UK Medical Research Council (MRC) and the Onchocerciasis Control Programme and used this work to write her PhD. (1989, University of Liverpool, UK). She then travelled extensively for Save the Children, UK, to refugee camps in Africa and Asia to assist health staff in the control of vector-borne diseases before returning to West Africa in 1991 as senior entomologist for the MRC laboratories where she worked for the next three years on the National Impregnated Bednet Programme. From 1993-2002 she worked as co-ordinator for the MALSAT research group, Liverpool School of Tropical Medicine, developing methodologies for the use of geographical information systems, remote sensing and seasonal climate predictions in the control of infectious diseases of public health importance in the tropics. During this time she led projects funded by the UK Department for International Development, The UK Meningitis Research Foundation, The World Health Organisation, The African Programme for Onchocerciasis Control and the European Union.

#### Research Interests

Her focus remains the development of new tools for health services in poor countries in which climate and environment are a major determinant of disease transmission dynamics and population vulnerability. She is particularly interested in the development of predictive models of epidemic risk based on climate/environmental variables and the use of such models in early warning systems. In recent years she has extended her collaborative activities outside of the health community and become involved in programmes involving climate groups such as the UK Met Office, the European Centre for Medium Range Weather Forecasting and the African Centre for Meteorology and Development. She has helped facilitate the development of active partnerships between the health and climate community and sees this as an essential step in the development of the use of climate/environmental information by the health sector. Future research efforts will concentrate on integrating knowledge on climate variability, climate and environmental/landcover/use change alongside socio-economic drivers to explain and predict spatial and temporal changes in health outcomes.

She is an active member of the WHO Roll Back Malaria Technical Support Network Prevention and Control of Malaria Epidemics, the WMO-CCI Expert Team 3.8 on Health-related Climate Indices and their Use in Early Warning Systems and the Millennium Ecosystems Assessment (where she is a lead author for the chapter on infectious diseases). She is a member of the CGIAR System-wide Initiative on Malaria and Agriculture (SIMA) Scientific Technical Advisory Panel

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## Climate and disease in Africa

### Overview

The importance of infectious disease as a determinant (as well as an outcome) of poverty has recently become a prominent argument for international and national investment in the control of infectious disease, as can be seen in the recently articulated United Nations (UN) Millennium Development Goals (MDGs). Climate variability and land use change have an enormous impact on health in West Africa, and may yet undermine the potential for achieving the MDGs, in certain economic-ecological zones. However, their underlying role in determining the burden of disease in the region on a yearly or decadal basis has never been systematically studied. In order to improve our understanding of the future impacts of climate change, it may be more effective to start by investigating the impact of inter-annual climate variability, and short-term shifts in climate (e.g., decadal), on disease transmission dynamics. This information may inform both current and future policy decisions with regard to prediction, prevention, and management of adverse climate-related health outcomes. In this session we will review current knowledge of changes in the epidemiology of infectious diseases associated with climate/environment and climate variability in West Africa over the last 40 years. Selected examples are considered from bacterial (meningococcal meningitis), protozoan (malaria), and filarial (onchocerciasis, loa loa and lymphatic filariasis) infections where spatial and temporal disease patterns have been directly influenced by seasonal, interannual, or decadal changes in climate. The role of remote sensing and GIS in elucidating the relationship between climate/environment and disease will be discussed.

### 2. The development of epidemic early warning systems

Epidemics of infectious diseases remain a scourge of the developing world. Two diseases, malaria and meningitis, cause an enormous burden of ill-health and associated mortality and have a devastating effect on socio-economic development, particularly in Africa. However both these diseases show a close link to weather patterns and, with reliable seasonal climate forecasts and weather monitoring, may be predictable months in advance. Here we compare and contrast these two diseases in order to elaborate when, where and how effective epidemic early warning systems may be developed.

#### Meningitis

Meningococcal meningitis is both preventable (through vaccination) and treatable (through drug therapy) and yet its effects continue to devastate populations in Africa. The public health importance of this disease is concentrated in the "meningitis belt"<sup>1</sup> (see Map 1), where large spreading epidemics occur every 5-10 years with attack rates of 400-500/100 000 population and case fatality rates even with treatment of 5-10%. In its epidemic form it is a disease that significantly affects young adults as well as children and, as a notifiable disease, causes considerable political as well as social concern.

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<sup>1</sup> This is the area between Senegal and Ethiopia and includes all or part of at least 15 countries, with an estimated total population of approximately 300 million, according to the World Health Organisation (WHO).

## Malaria

Malaria is both preventable (through social and environmental control; including use of insecticides) and treatable (through drug therapy) yet up to 2.7 million people die from it each year (Bremen 2001). A staggering 90% of these deaths occur in Sub-saharan Africa, predominantly in children. It is primarily a disease of the poor and is recognized as a major impediment to socio-economic development. Epidemics of malaria affecting all age groups occur in largely non-immune populations living on the fringes of malaria transmission. In Africa alone over 100 million people live in these epidemic zones (see Map 2).

## Practical

**The aim of this exercise is to explore the relationship of satellite data to malaria using widely available freeware WinDisp and satellite data in the public domain.**

WinDisp<sup>2</sup> software has its origins with the Global Information and Early Warning System (GIEWS) of the Food and Agriculture Organization of the United Nations. The GIEWS monitors the global food supply and demand and provides timely warnings about both food shortages and surpluses for individual countries. The software allows users to compare multiple images; extract and graph trends from a number of satellite images, such as during the growing season for comparison with other years; compute new images from a series of images; build custom products combining images, maps and specialised legends; and to display tabular data in map format. The system has been exploited for use in malaria epidemic early warning.

## Suggested reading

Thomson M.C. Connor, S.J., Ward, N., and Molyneux (2004). Climate variability and infectious disease in West Africa. *Ecology and Health Vol 1, Issue 2*.

Molesworth, A.M. Cuevas, L.E. Connor, S.J. Morse, A.P. and Thomson. M.C. (2003). Environmental risk and meningitis epidemics in Africa. *Emerging infectious diseases*. 9, 10. <http://www.cdc.gov/ncidod/eid/vol9no10/03-0182.htm>

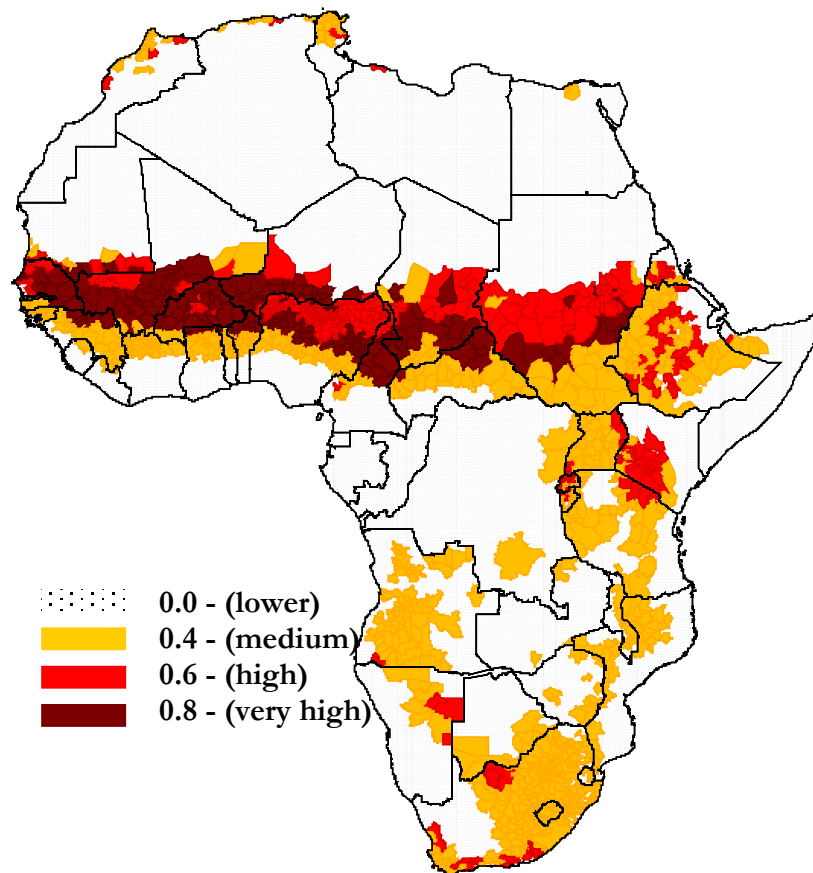
WHO (2001) Malaria Early Warning Systems, Concepts, Indicators and Partners, "A framework for field research in Africa" . Roll Back Malaria / Technical Support Network for Prevention and Control of Malaria." *WHO/CDS/RBM/2001.32* (WHO, 2001). [http://mosquito.who.int/cmc\\_upload/0/000/014/807/mews2.pdf](http://mosquito.who.int/cmc_upload/0/000/014/807/mews2.pdf)

Connor, S.J., Flasse, S., Perryman, A., & Thomson, M.C.(1998). Environmental information systems; can they help improve malaria risk mapping and forecasting of epidemics? *Disasters* 22 (1) 39:56

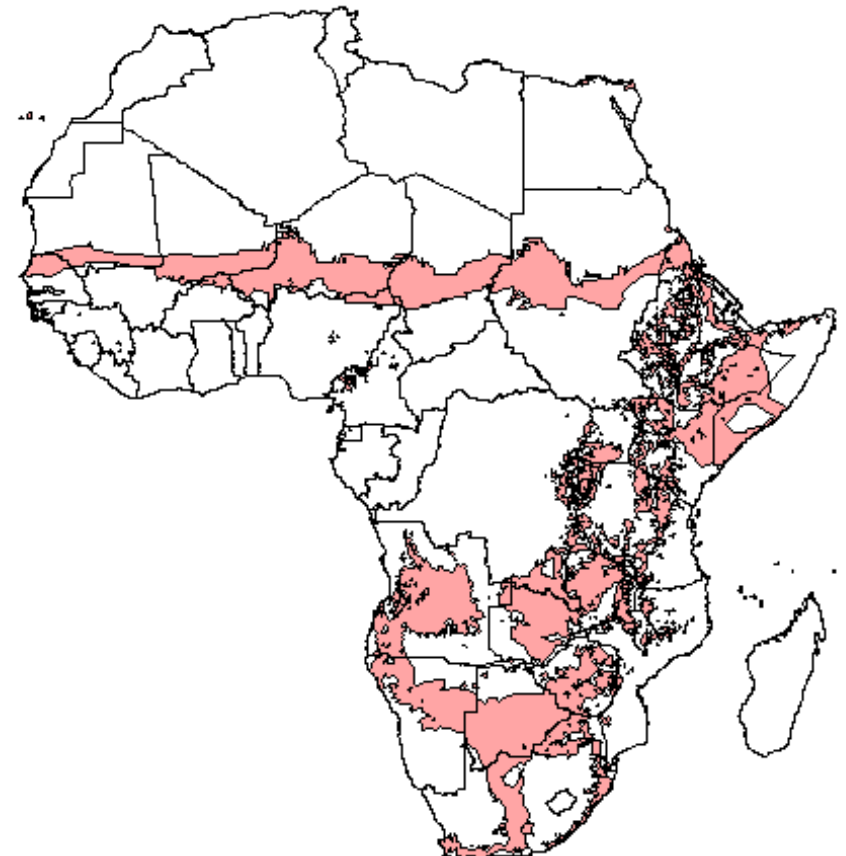
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<sup>2</sup> <http://www.fao.org/giews/english/windisp/manuals.htm>

Map 1. Epidemic meningitis zone



Map 2. Epidemic malaria zone



Molesworth, A.M. Cuevas, L.E. Connor, S.J. Morse, A.P. and Thomson. M.C. (2003). Environmental risk and meningitis epidemics in Africa. *Emerging infectious diseases*. 9, 10. <http://www.cdc.gov/ncidod/eid/vol9no10/03-0182.htm>

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