POPULATION GROWTH RATE IN AREAS ENDEMIC FOR INSECT-BORNE DISEASES

GENERAL CONSIDERATIONS	
Issues	Insect-borne diseases
Type of indicator	Exposure (proximal/pressure)
Rationale	One of the main causes of increased exposure to insect-borne diseases is the growth of population in areas in which disease vectors are endemic. This indicator provides a measure of the population growth rate in these areas.
Issues in indicator design	Construction of this indicator requires two factors to be defined: the extent of areas endemic for insect-borne diseases and the population growth rate in these areas. In principle, the latter should pose little problem, for national censuses typically provide relatively reliable information on population numbers and change. Many of the areas most severely affected by insect-borne diseases, however, are also areas in which there have been major population displacements, either because of natural events (such as drought and famine) or because of war. In these areas, data on population change are far less reliable. Problems may also exist in defining the areas endemic for insect-borne diseases, especially in more remote areas where field data are scarce.
SPECIFICATION	
Definition	Mean annual rate of population growth in areas endemic for insect-borne diseases.
Terms and concepts	***Population growth:*** the average percentage change in the population within a pre-defined area, including long-term residents and displaced people, but excluding tourists and temporary visitors, relative to a base year. Note that the population change is measured within the same area (irrespective of any change in the extent of the endemic extent of the disease). ***Insect-borne diseases:*** vector-borne diseases for which insects act as a primary agent of transmission; these include malaria, dengue, yellow fever, onchocerciasis, leishmaniasis and trypanosiamiasis. ***Areas endemic for insect-borne:*** geographic areas in which conditions exist to allow the stable transmission of these diseases, from year-to-year.
Data needs	Boundaries of areas endemic for insect-borne diseases. Population numbers (for base and latest year).
Data sources, availability and quality	Data on the extent of areas endemic for insect-borne diseases are likely to come from several sources, including field-based and model-based research projects, and routine monitoring by national and international agencies. In some cases, where routine field monitoring occurs, endemic areas can be defined on the basis of direct observation either of the vector species or of disease rates. In other cases, they may need to be estimated by defining habitats and environmental conditions considered to favour stable transmission of the disease – e.g. vegetation, land use, climate. Satellite data are increasingly valuable data sources in this context. In either case, estimates of the area endemic for the insect vectors are susceptible to considerable uncertainties due to inadequacies in the source data and incomplete understanding of the habitat requirements and transmission processes. Data on population numbers can usually be obtained from national censuses, and where these are available the data may be considered broadly reliable. Censuses are usually carried out at relatively long intervals, so estimates for intermediate years may need to be made using modelling techniques, and will be open to greater uncertainty. Major uncertainties may also occur in

	areas affected by population displacement. Population numbers in the areas defined as endemic for insect-borne diseases may need to be calculated by intersecting the boundaries of these areas with maps of population data (e.g. using GIS techniques). Where the boundaries of the census districts are not concordant with the boundaries of the endemic area, interpolation techniques may be necessary to assess population numbers.
Level of spatial aggregation	Region
Averaging period	Decadal (or shorter term where suitable data exist)
Computation	The indicator can be computed as a simple percentage change: *100 * (Pcurr – Pbase) / (Years * Pbase)* where: *Pcurr* is the population in the endemic area in the current (or latest) year; *Pbase* is the population in the endemic area in the base year; *Years* is the number of years between the base and current year.
Units of measurement	Percentage change
Worked example	Assume that an area defined as endemic for insect-borne diseases contained a population of 1 558 000. Assume that 10 years later the population within the same endemic area is 1 910 700. In this case, the value of the indicator is: 100 * (1 910 700 – 1 558 000) / (10 * 1 558 000) = 2.3%
Interpretation	This indicator provides a measure of the population growth rate in areas considered to be endemic for insect-borne diseases. As such, an increase in the indicator can be interpreted as evidence of a rise in the number of people at risk; a reduction can be interpreted as evidence of a decline in the numbers at risk. Because population growth is also in many cases associated with land use and other changes affecting the potential for disease transmission and habitat availability for the insect vectors, the indicator also provides indirect information on potential future changes in disease risk. Considerable care is needed in interpreting the indicator, because of uncertainties in the source data, and difficulties in defining precisely areas endemic for insect-borne diseases and the populations affected. Crude population numbers are also not the only factor to determine the level of risk: the vector intensity within the area, the detailed distribution of the vector and target population, and population characteristics (e.g. general health, level of immunization) are important co-determinants. In addition, changes may occur in the extent of the endemic area over time, so this indicator is best interpreted in combination with other indicators on the extent of insect-borne diseases.

Variations and alternatives	The indicator proposed here is non-specific in that it includes all forms of insect-borne diseases. In many situations, however, it may be more appropriate to define the indicator separately for different diseases – e.g. malaria, yellow fever. This is especially the case where these have different distributions and potentially affect different populations, with different growth dynamics.
Examples	WHO *Environmental health indicators: framework and methodologies* • **Population at risk from vector-borne diseases**
Useful references	MARA (Mapping Malaria Risk in Africa) website: http://www.mara.org.za WHO 1994 *Information systems for the evaluation of malaria control programmes, a practical guide. AFRO/CTD/MAL/ 94.3.* Brazzaville: World Health Organization Regional Office for Africa. WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf)