BOX 3.7 *The influence of first-nature geography: is it possible to eradicate malaria?*

The species of Plasmodia that cause human malaria most likely reached their maximum global extent in 1900. Since that time the affected area has been progressively reduced by a regionally variable mixture of improving human conditions and deliberate control. The map below shows the difference between the widest hypothesized extent of the distribution of all types of human malaria around 1900[a] and the contemporary limits of *Plasmodium falciparum,*[b] the most clinically severe and epidemiologically important form of human malaria, in 2007. The formerly malarious areas are concentrated in the temperature latitude extremes of the parasite's ancestral distribution, in both the Northern and Southern Hemispheres.

Researchers have documented the strong inverse correlation between the economic prosperity of nations and their contemporary malaria burden.[c] Richer countries have less malaria, poorer countries more. This work also documents the many mechanisms, from individual to macroeconomic, for malaria to contribute to poverty. What if the constraint of malaria were lifted? Is it possible to eradi-

cate malaria? The question has never been satisfactorily answered at the global scale.[d]

But it is possible to start addressing the problem. In the map below, risk is classified as stable if more than 0.1 case is recorded per 1,000 population each year, unstable if below this figure, and zero if no cases have been recorded within the three most recent years of records. When overlaid on a population map for 2007,[e] 2.37 billion people were found to live in areas with any risk of *P. falciparum* transmission. Globally, almost 1 billion people lived under unstable, or extremely low, malaria risk. Conditions of low risk are typical in the Americas and in South and East Asia but are also common in Africa.

For 1 billion people at risk of unstable malaria transmission, malaria elimination is epidemiologically feasible. Epidemiological feasibility was determined by reference to historical experience during the global malaria eradication program and by inferring, through modeling, that transmission could be interrupted by taking insecticide-treated bednets to scale.[f] There are many reasons in many regions why elimination may not be a simple mat-

ter of epidemiological feasibility. Political instability and geographic accessibility are obvious examples, but these are operational and not technical obstacles.

What can be achieved with the 1.37 billion people suffering stable risk? Initial evidence suggests that a substantial fraction of those affected will be living in areas of very low prevalence.[g] A detailed investigation with mathematical models could estimate the impact from the existing toolkit of interventions. When this estimate combined with a detailed analysis of the data on the efficiency of historical interventions, considerable insight could follow. These approaches will help determine whether malaria is eradicable and, if so, under what time frame and with what resources.

Contributed by Simon Hay, David L. Smith, and Robert W. Snow.
a. Hay and others 2004; Lysenko and Semashko 1968.
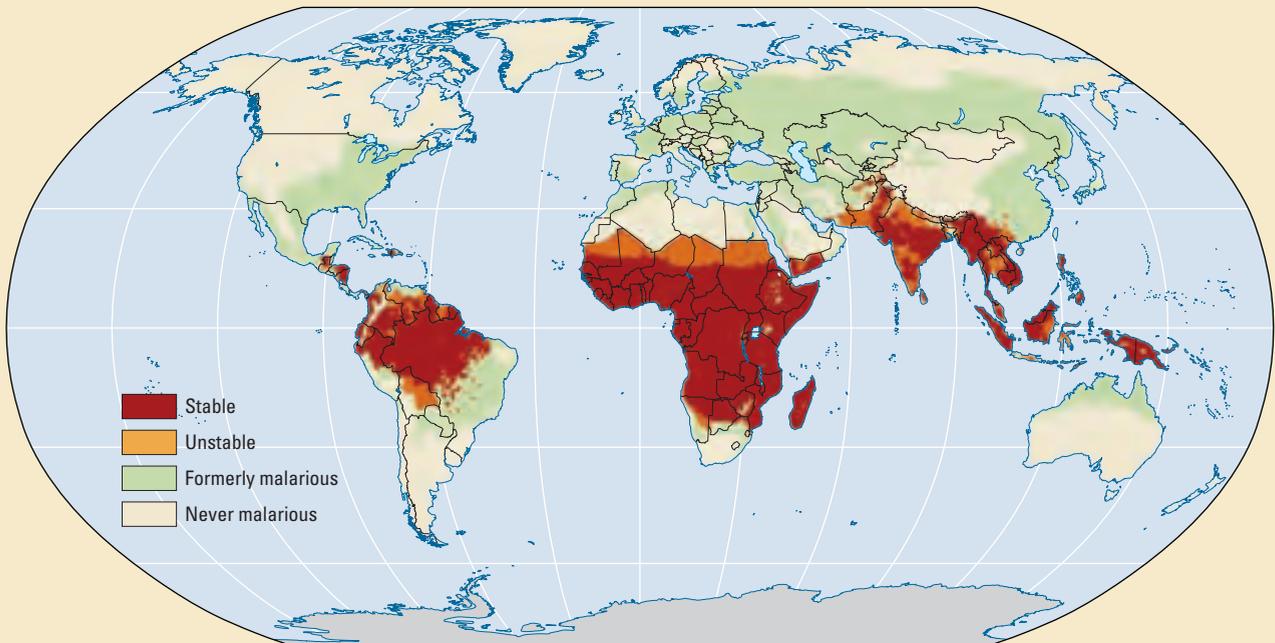b. Guerra and others 2008.
c. Sachs and Malaney 2002.
d. Roberts and Enserink 2007.
e. Balk, Deichmannand others 2006.
f. Hay, Smith, and Snow, forthcoming.
g. Guerra 2008.

Currently prosperous parts of the world were formerly malarious

Legend:
- Stable
- Unstable
- Formerly malarious
- Never malarious

Source: Malaria Atlas Project (MAP), Kenyan Medical Research Institute, and University of Oxford.