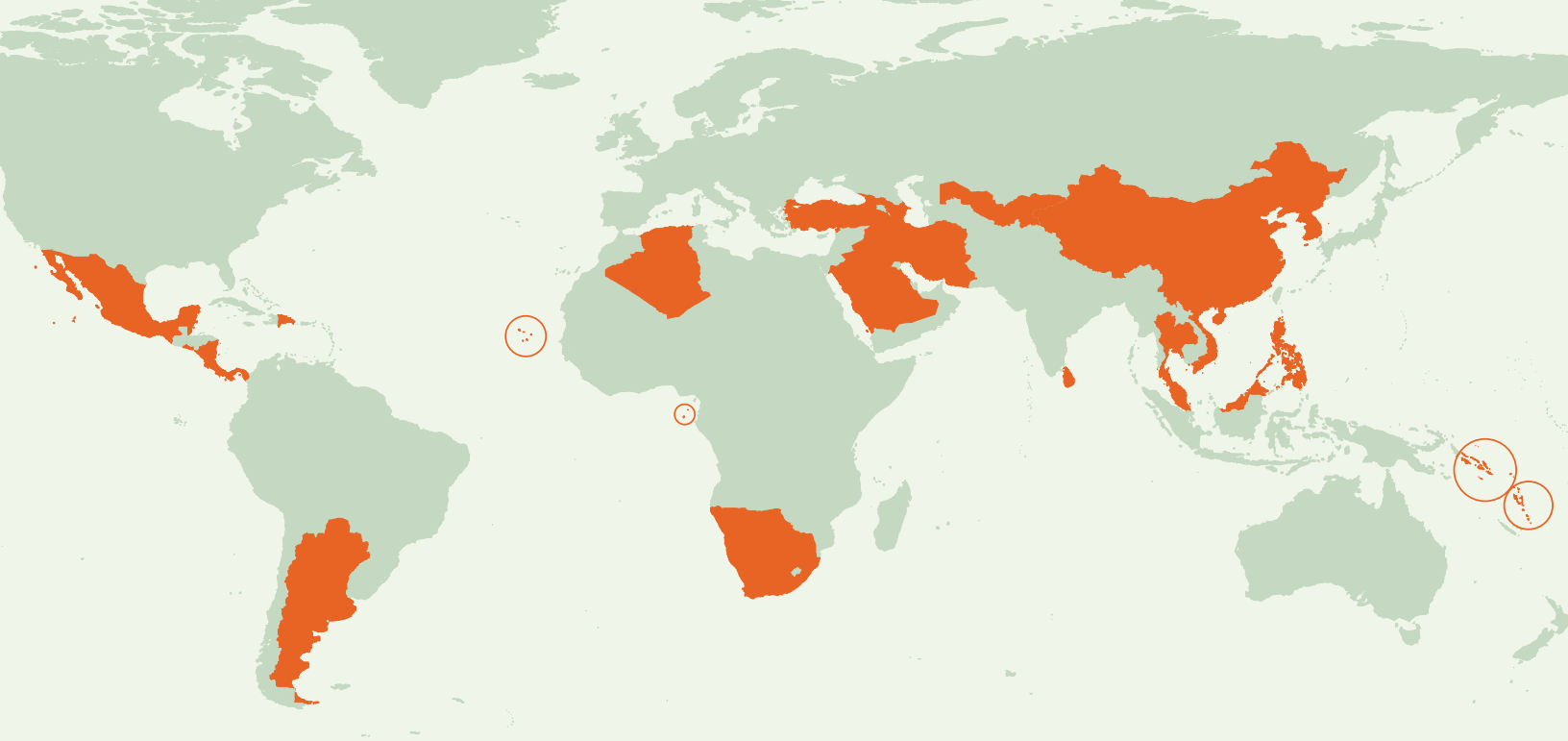

Atlas of Malaria-Eliminating Countries, 2011

UCSF GLOBAL HEALTH SCIENCES
THE GLOBAL HEALTH GROUP
From evidence to action

in partnership with

map
malaria atlas project

Atlas of Malaria-Eliminating Countries, 2011

By The Global Health Group
University of California, San Francisco
in partnership with Malaria Atlas Project
University of Oxford, UK

October, 2011
San Francisco, California

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This document is a product of the Global Health Group at the University of California, San Francisco, and the Malaria Atlas Project. The information contained herein rests on a thorough analysis of currently available data. Interpretation and use of the information is the responsibility of the reader. Information and maps will be updated over time, and published online at www.malariaeliminationgroup.org. Country designations do not express any judgment by the Malaria Elimination Group, the Global Health Group or the Malaria Atlas Project concerning the legal status of any country or territory. References to companies or products do not reflect endorsement or preference by the Malaria Elimination Group, the Global Health Group or the Malaria Atlas Project.

Disclaimer: Any information derived from this *Atlas* is not an appropriate source for travel advice on malaria risk. Always consult your physician for the latest advice prior to travel.

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Preface

REMARKABLE PROGRESS IN SHRINKING THE MALARIA MAP has been achieved throughout the world over the last hundred years. Seventy-nine countries have eliminated malaria since 1945, in large part because of the success of the World Health Organization's Global Malaria Eradication Program from 1955 to 1969. Major achievements have occurred recently: since 2000, 43 countries halved the number of reported cases; and today, of the remaining 99 endemic countries in the world, 36 are in the process of moving from controlled low-endemic malaria to elimination. These 36 countries have embarked on national or subnational malaria elimination strategies and have already made substantial progress in greatly reducing malaria.

The Global Health Group at the University of California, San Francisco and the Malaria Atlas Project (MAP) have come together to produce the *Atlas of Malaria-Eliminating Countries*. The maps contained within the *Atlas* were developed by MAP in close collaboration with the national malaria-control programs of the 36 malaria-eliminating countries. Many of the maps have already been published in peer-reviewed literature, while others have been recently updated and are shown here for the first time. Many of the malaria-eliminating countries played a critical role in the development of the *Atlas* by contributing data, reviewing country maps and drafts, and providing suggestions for improvement. Additional information on individual contributions can be found in the Acknowledgments section.

The *Atlas* is a visual tool for the malaria-eliminating countries as well as the local, regional, and global partners that support their efforts to eliminate malaria. The *Atlas* furthers understanding about malaria at the country and regional levels through a series of maps: first, maps that show the limits and intensity of *Plasmodium falciparum* and *Plasmodium vivax* transmission; second, human population density maps that show where populations live in the malaria-eliminating countries; and third, maps that show the distribution of the dominant malaria vector species together with summary bionomics data to predict the behavior and location of each vector species. In addition to these maps, country information such as malaria burden, health and economic indicators, and goals for malaria elimination are presented.

The *Atlas* is intended to be a living document and will undergo periodic updates as new data and information become available. The *Atlas* is available on the Web (www.malariaeliminationgroup.org) and in hard copy. In addition to the global atlas, a regional *Atlas of the Asia Pacific Malaria Elimination Network* highlights the 11 countries within the Asia Pacific working to eliminate malaria from the region and is available on the Web (www.apmen.org) and in hard copy. We encourage all those working in malaria to contribute feedback on the information provided in these documents in order to facilitate and improve future editions of these malaria elimination atlases.

The *Atlas of Malaria-Eliminating Countries* brings together national malaria programs, researchers, and specialists in geospatial modeling to examine and enhance malaria mapping to the benefit of countries eliminating malaria. In doing so, we hope to highlight the current progress being achieved in the 36 malaria-eliminating countries and to contribute to the goal of a malaria-free world.

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The *Atlas of Malaria-Eliminating Countries* was produced by the Global Health Group at the University of California, San Francisco (UCSF) and the Malaria Atlas Project (MAP). The authors are deeply grateful to the numerous people who contributed to this *Atlas*, particularly the national malaria programs of the 36 malaria-eliminating countries and the many national and international partners, malaria program implementers, and researchers who provided the data and information presented in this *Atlas*. Furthermore, the authors appreciate the time and feedback from some of the malaria-eliminating countries who participated in the review of country maps and data. Additional gratitude goes to the Global Malaria Program at the World Health Organization for its continued leadership and support in malaria control and elimination.

The UCSF Global Health Group produced the final document. Chris Cotter provided overall management, production, and drafting of text for the *Atlas*; Cara Smith Gueye facilitated feedback from the Asia Pacific malaria-eliminating countries; Sir Richard Feachem, Roly Gosling, and Allison Phillips provided overall guidance, writing support, and strategic vision for the *Atlas*; Kerstin Svendsen formatted the *Atlas* and provided overall design support; Harmonie Adams, Jessie de Jarnette, Janelle Downing, Miriam Hartmann, and Saehee Woo provided data collection and research support; Elizabeth Brashers, Michelle Hsiang, and Jimee Hwang provided helpful suggestions for improvement during the drafting of the *Atlas*.

The Malaria Atlas Project (MAP) provided all of the maps contained within the *Atlas*. Simon Hay provided overall guidance and strategic vision for the *Atlas*; Catherine Moyes and Simon Hay contributed writing and review support for text and other content within the *Atlas*; the map products themselves and the vector bionomics summaries were generated by Marianne Sinka, Pete Gething, Anand Patil, Carlos Guerra, Andy Tatem, and Will Temperley using data and expert opinions contributed by the individuals listed below.

The authors wish to express their gratitude to the Exxon Mobil Corporation for supporting the production of the *Atlas* through a grant to the UCSF Global Health Group. All contributions made by the Malaria Atlas Project, including the generation of the maps and the vector tables, were funded by the Wellcome Trust, and augmented in the Asia region by the Li Ka Shing Foundation. The authors are grateful for the support from malaria-eliminating countries in the Asia Pacific Malaria Elimination Network (APMEN) in the development of the *Atlas*. Major funding for APMEN is provided by the Australian Agency for International Development (AusAID).

Contributors of unpublished data to the transmission limits maps are: Global Malaria Program, World Health Organization; Elkhan Gasimov, World Health Organization Regional Office for Europe, Baku, Republic of Azerbaijan; Thinley Yangzom, Sonam Gyeltshen and Karma Lhazeen, Vector-Borne Disease Control Programme, Department of Public Health and Ministry of Health, Gelephu, Kingdom of Bhutan; Merab Iosava and Irine Kalandadze, Outbreak and Bioterrorism Response Division, National Center for Disease Control and Public Health, Georgia, and Giorgi Kurtsikashvili, World Health Organization Country Office in Georgia; David Joa, Centro de Control de Enfermedades Tropicales, Ministerio de Salud Pública y Asistencia Social, Santo Domingo (DN), Dominican Republic; World Health Organization Regional Office for South East Asia, New Delhi, Republic of India; Christina Rundi, Disease Control Division, Ministry of Health, Malaysia; Juan E. Hernandez, Instituto Nacional de Salud Pública, Cuernavaca, Mexico; Jose E. Calzada, Departamento de Control de Vectores, Ministerio de Salud, Panama City, Panama; Servicio Nacional de Erradicación del Paludismo (SENEPA), Ministerio de Salud Pública y Bienestar Social, Asunción, Republic of Paraguay; Dorina G. Bustos and Ma. Cristina Galang, Research Institute for Tropical Medicine and Malaria Control Program, Department of Health, Manila, Philippines; Jung-Yeon Kim, Department of Malaria and Parasitic Disease, National Institute of Health, Seoul, Republic of Korea; World Health Organization Regional Office for the Eastern Mediterranean, Cairo, Arab Republic of Egypt; Gawrie N. Galappaththy, National Malaria Control Programme, Ministry of Health, Colombo, Democratic Socialist Republic of Sri Lanka; Rajendra Maharaj, Malaria Research Program, Medical Research Council, Durban, South Africa; Nargis Saparova, World Health Organization Country Office in Tajikistan, Dushanbe, Republic of Tajikistan; Supawadee Poungsombat, Jirapat Ketkaew, and Wichai Satimai, Bureau of Vector Borne Diseases, Department of Disease Control, Ministry of Public Health, Thailand; Seher Topluoğlu, Malaria Control Department, Ministry of Health, Ankara, Republic of Turkey; Nguyen Manh Hung, National Institute of Malariology, Parasitology and Entomology (NIMPE), Ministry of Health, Hanoi City, Socialist Republic of Vietnam.

Contributors of expert opinions and unpublished data to the malaria vector maps are: Michael Bangs, Mauricio Casas, Theeraphap Chareonviriyaphap, Maureen Coetzee, Ralph Harbach, Janet Hemingway, Sylvie Manguin, Charles M. Mbogo, and Yasmin Rubio-Palis.

Executive Summary

DESPITE THE HEAVY BURDEN OF MALARIA WORLDWIDE, SIGNIFICANT GAINS against this ancient disease are being made. Since 1945, 79 countries have successfully eliminated malaria from their borders, the latest being Turkmenistan, which attained World Health Organization malaria-free certification in 2010. Today, 99 malaria-endemic countries remain, and of those, 36 have embarked on the task of malaria elimination. The *Atlas of Malaria-Eliminating Countries* is a visual tool to assist the national programs of these 36 malaria-eliminating countries, and is designed to be a resource to help national malaria programs raise global awareness about efforts to control and eliminate malaria.

Malaria risk is dependent on a variety of factors, including the distribution of the human population, vector abundance and biting and breeding behavior, socioeconomic development, and access to and coverage of malaria control interventions. The *Atlas* presents country-level maps of some of the key determinants in planning for malaria control and elimination. These include:

- *P. falciparum* and *P. vivax* transmission limits maps, refined with temperature and aridity data, which provide an estimate of where the malaria risk is and classify risk into unstable, low stable, and stable transmission;
- Human population density maps that show where the population lives in malaria-eliminating countries; and
- Maps of the dominant malaria vector species, which together with summary bionomics data predict where each vector species occurs and how each is likely to behave.

Malaria indicators and health and socioeconomic data for each country are provided to help develop a comprehensive understanding of the health and economic context. To highlight the progress currently being made towards elimination, national and subnational strategic elimination goals, where identified, are included.

The maps within the *Atlas of Malaria-Eliminating Countries* represent a picture of the recent past, compiled from available data. The *Atlas* is a living document and will change as gaps in data are filled and programs provide updated data reflecting their success in shrinking the malaria map. Through this visual tool, the *Atlas* establishes a baseline of the current malaria situation in the 36 malaria-eliminating countries, helping to track progress toward elimination while highlighting the challenges countries face as they move toward becoming malaria-free.

Introduction

LARGE-SCALE EFFORTS TO CONTROL AND ELIMINATE MALARIA over the last hundred years have succeeded in shrinking the malaria map.(1) In 1950, only 30% of the global population living in 30 countries was malaria-free compared to an estimated 50% living in 109 countries today.(2, 3) Much of this success is attributed to the World Health Organization's (WHO) Global Malaria Eradication Program of the 1950s and 60s. Between 1945 and 2010, 79 countries successfully eliminated malaria, with Turkmenistan being the most recent to attain WHO malaria-free certification.(4) The WHO eradication program was abandoned in 1969 due to administrative, financial, and technical issues, however, most countries that eliminated malaria have maintained their malaria-free status and many more are continuing on the path to becoming malaria-free.

Today steady reductions in malaria transmission continue in all parts of the world, driven by economic development, urbanization, and scaling up of lifesaving interventions such as bed nets, insecticide use, malaria diagnostics, and drug treatments. Thus, total cases of malaria and deaths associated with malaria are trending downward. Between 2000 and 2009, of the 99 malaria-endemic countries, 50 experienced a decrease of greater than 25% in reported malaria cases, and 43 experienced a decrease of more than 50% in reported malaria cases.(4)

Thirty-six of these countries are in the process of moving from controlled low-endemic malaria to elimination. We have termed these 36 countries as malaria-eliminating countries, and they are showcased in this *Atlas of Malaria-Eliminating Countries*.(1, 5) Most of the malaria-eliminating countries have formally declared a national, evidence-based elimination goal, have assessed the feasibility of such a goal, and have embarked on a malaria-elimination strategy. Other countries are strongly considering an evidence-based national elimination goal, and have already made substantial progress in spatially-progressive elimination, for example, by eliminating malaria from specific islands, provinces, or geographical areas.

Although most of the 36 malaria-eliminating countries lie along the endemic margins of the disease, they represent a wide range in size, economy, geography, and physical characteristics. They include islands, such as Cape Verde, which covers 4,000 km^2 with approximately 510,000 inhabitants, Costa Rica, which spans more than 51,100 km^2 and has a population of 4.6 million, and mainland giant China, which has 1.3 billion people across 9.6 million km^2. Countries[1] range from low- to high-income, with the gross national income (GNI) per capita ranging from US$800 to $19,890. Health expenditure likewise spans a broad range across the 36 countries, from $38 to $1,108 per capita.(6) Geographically the countries represent the extremes in altitude from the Himalayas to tropical lowland areas.

Specific challenges in malaria elimination vary substantially among countries and regions, yet common themes exist. One of the most prominent challenges across the malaria-eliminating countries is *Plasmodium vivax*. Only seven of the malaria-eliminating countries (Botswana, Cape Verde, Dominican Republic, Namibia, São Tomé and Príncipe, South Africa, and Swaziland) have a malaria burden that is due solely or mainly to *Plasmodium falciparum*. The remaining 29 countries either experience a mix of *P. vivax* and *P. falciparum* or have solely *P. vivax* malaria. South and East Asia have an estimated 52% of all *P. vivax* infections in the world.(7) In other regions, such as Latin America, *P. vivax* infections can make up more than 90% of all malaria infections (for example, in Belize, Costa Rica, El Salvador, Mexico, Panama, and Paraguay).(4) The predominance of *P. vivax* is an important consideration when designing malaria control and elimination strategies. *P. vivax* has a persistent liver stage, the hypnozoite, which makes it less susceptible to control and elimination efforts. This liver stage can trigger relapses of infection that most commonly occur within a month, but can occur years later. *P. vivax* infections are often asymptomatic or cause mild symptoms. This means they often remain undiagnosed and untreated, resulting in long periods during which the infection can be passed on to other mosquitoes.

The effective treatment for the dormant liver stage of *P. vivax* is primaquine.(8) This drug has challenges for adherence because of the length of the treatment (14 days) and the bitterness of the tablet. Primaquine can also have severe side effects. It may cause haemolysis in patients with an underlying deficiency of glucose-6-phosphate dehydrogenase (G6PD), an inherited blood disorder. Currently, no easy to use point-of-care test for G6PD deficiency exists. Therefore, in populations that have a high risk of this genetic disorder, primaquine is not used, allowing the liver stage of *P. vivax* malaria to be a reservoir of infection, and slowing the march towards elimination. In order for *P. vivax* to be eliminated, an alternative to the 14-day treatment of primaquine must be found and is a notable technology gap that needs to be addressed.

1 Figures for gross national income (GNI) and per capita health expenditure do not include the Democratic People's Republic of Korea, for which no data were available in the World Bank's World Development Indicator database.

One significant challenge for all malaria-eliminating countries is the migration of populations across national borders and between malaria-endemic and non-endemic areas. Human migration, especially among vulnerable populations such as undocumented or seasonal workers, varies enormously by economic and geographic circumstance, and greatly increases the risk of malaria importation and outbreaks. All continents face this problem, from the Himalayan Kingdom of Bhutan, where malaria is imported from the neighboring state of Assam in India, to Argentina in South America, Namibia in southern Africa, and Tajikistan in Central Asia, which experience imported malaria cases annually along their respective borders with Bolivia, Angola, and Afghanistan.(9–12)

A national malaria program's ability to address imported malaria relies on a strong surveillance system and benefits from multicountry collaborations.(13, 14) Many of the malaria-eliminating countries are in the forefront of this work. Mozambique, South Africa, and Zimbabwe are embarking on a cross-border initiative aimed at achieving universal coverage of key malaria interventions in border provinces with the goal of reducing transmission and preventing importation of malaria into South Africa.(15) Similarly, China is working along the border with Myanmar to boost the diagnosis, treatment, and prevention of malaria due to the high number of cases being imported.(16) On the Arabian Peninsula, Saudi Arabia and Yemen are working together to control malaria along their shared border through health staff training and increased indoor residual spraying in targeted areas with the goal of achieving an Arabian Peninsula free from malaria by 2015.(17, 18)

In several other countries, surveillance activities are integrating the newest technologies. For example, Botswana is working with a private technology company to use smartphone applications to monitor and track malaria case information to help the malaria program more quickly identify and deter malaria outbreaks.(19) Additionally, Mexico uses data from passive case detection, case investigations, and reactive screenings to map cases, identify risk factors for transmission, and target context-specific malaria control interventions.(13) El Salvador in Latin America and the Solomon Islands and Vanuatu in the Asia Pacific use geographical information systems for mapping malaria cases and coverage of interventions, enabling them to effectively track progress in their efforts to reach elimination.(20, 21)

A significant challenge in many malaria-eliminating countries—exacerbated by population migration—is the rise of drug resistance, specifically of *P. falciparum* to artemisinin (22) and *P. vivax* to chloroquine.(23) The Greater Mekong subregion in the Asia Pacific has been the traditional epicenter of antimalarial drug resistance.(24) Modeling suggests that the elimination of *P. falciparum* from this subregion is needed to prevent the spread of artemisinin-resistant parasites to other areas of the world.(25) Chloroquine-resistant *P. vivax* in some parts of the Asia Pacific has sparked concern, however studies to date have been inconclusive. Failing to mitigate these risks today could result in a weaker set of interventions and more resistant parasites tomorrow.(24) Drug resistance networks such as the Worldwide Antimalarial Resistance Network (WWARN, www.wwarn.org) and the World Health Organization, are monitoring this situation closely.(26)

Ensuring long-term commitment to achieving elimination and maintaining it for decades thereafter is a critical challenge for all countries in the pre-elimination, elimination, and prevention of reintroductions phases of malaria control.(14, 27) Sustaining financial commitment will be especially challenging for small countries with limited resources that may be reliant on external financial support. Sustained financing, whether from internal or external sources, has been the source of countless challenges for malaria control and elimination programs since the Global Malaria Eradication Program era. For example, by 1969, Zanzibar reduced malaria to such low levels that it was no longer a visible threat to public health.(28) The following year, interventions were abandoned and, as a result, malaria transmission intensity returned to previous high levels. This same pattern of reduced funding and intervention relaxation occurred in the 1980s, with a consequent rebound in transmission. Today, malaria transmission in Zanzibar has been reduced to extremely low levels again, yet this time commitment must be maintained in order to prevent resurgence.(29) A similar lesson can be found in Sri Lanka. In 1968, Sri Lanka experienced a resurgence of malaria with high death rates after relaxing control efforts following the successful reduction of malaria cases to very low levels.(30–32)

These experiences demonstrate the need for sustained financial and political commitment to ensure sustainability of the gains achieved so far.(33) Malaria-eliminating countries and their donors should develop alternative and innovative financing mechanisms such as earmarked taxes (for example, on tobacco, airline tickets, or the tourism industry) in order

to guarantee long-term funding.(14) The most successful elimination programs have depended on domestic financing; long-term political commitment is the most effective means of achieving sustained financing for elimination.

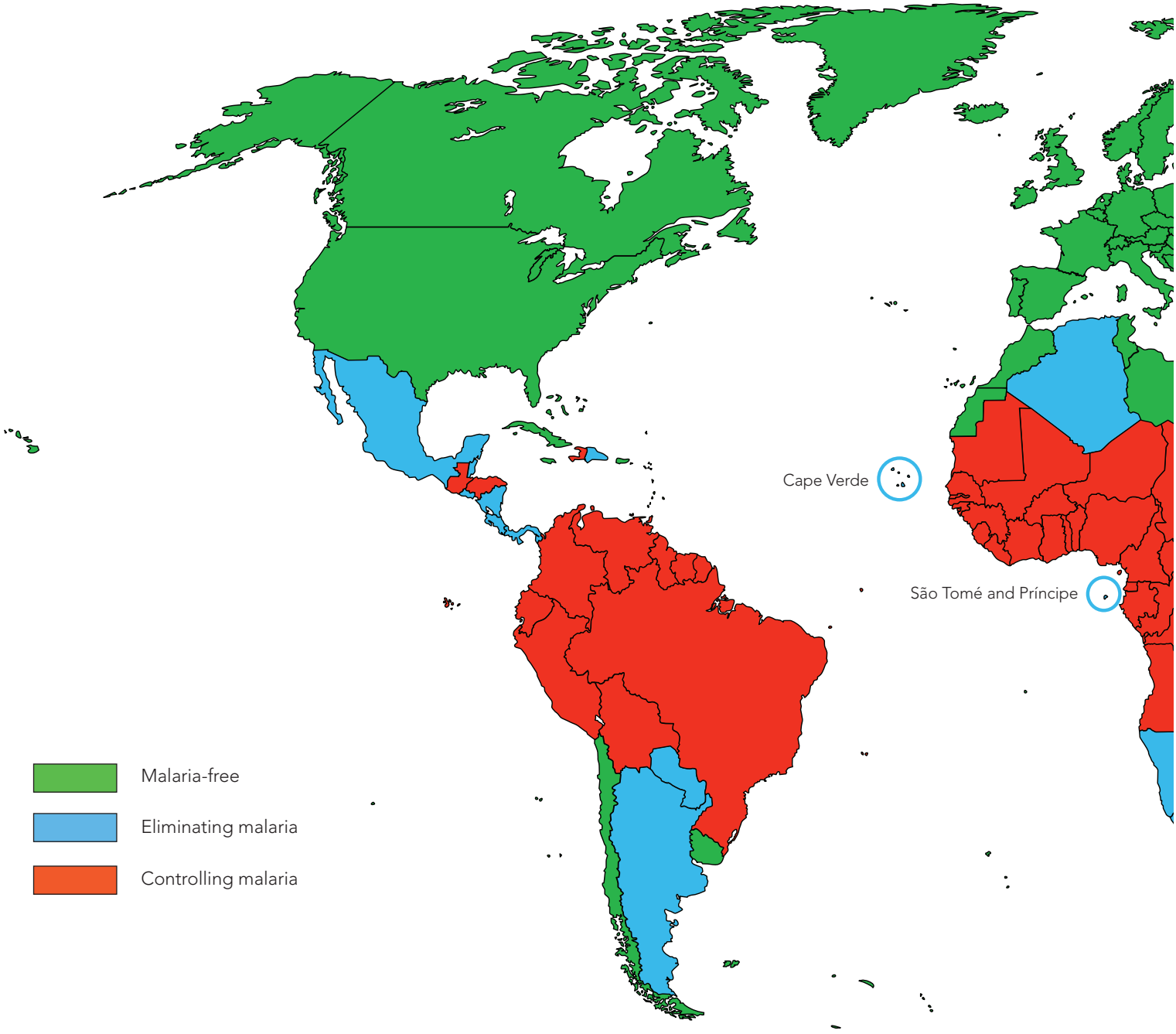
All of these challenges threaten progress toward elimination. Nevertheless, armed with an awareness of these potential obstacles, and bolstered by the knowledge of historical and recent success stories, the 36 malaria-eliminating countries are striving to progressively eliminate malaria. The *Atlas of Malaria-Eliminating Countries* seeks to establish a visual baseline from which to measure progress towards elimination in these countries. We show together for the first time, country-level maps and data behind the key elements that shape malaria transmission: the likelihood of transmission of both *P. falciparum* and *P. vivax*, human population density, mosquito vector occurrence, and malariometric and socio-economic indicators for context. Although the challenges faced by many of these countries are significant, progress towards elimination is inevitable with the energy and commitment of the malaria programs, their governments, and the funding agencies.

References

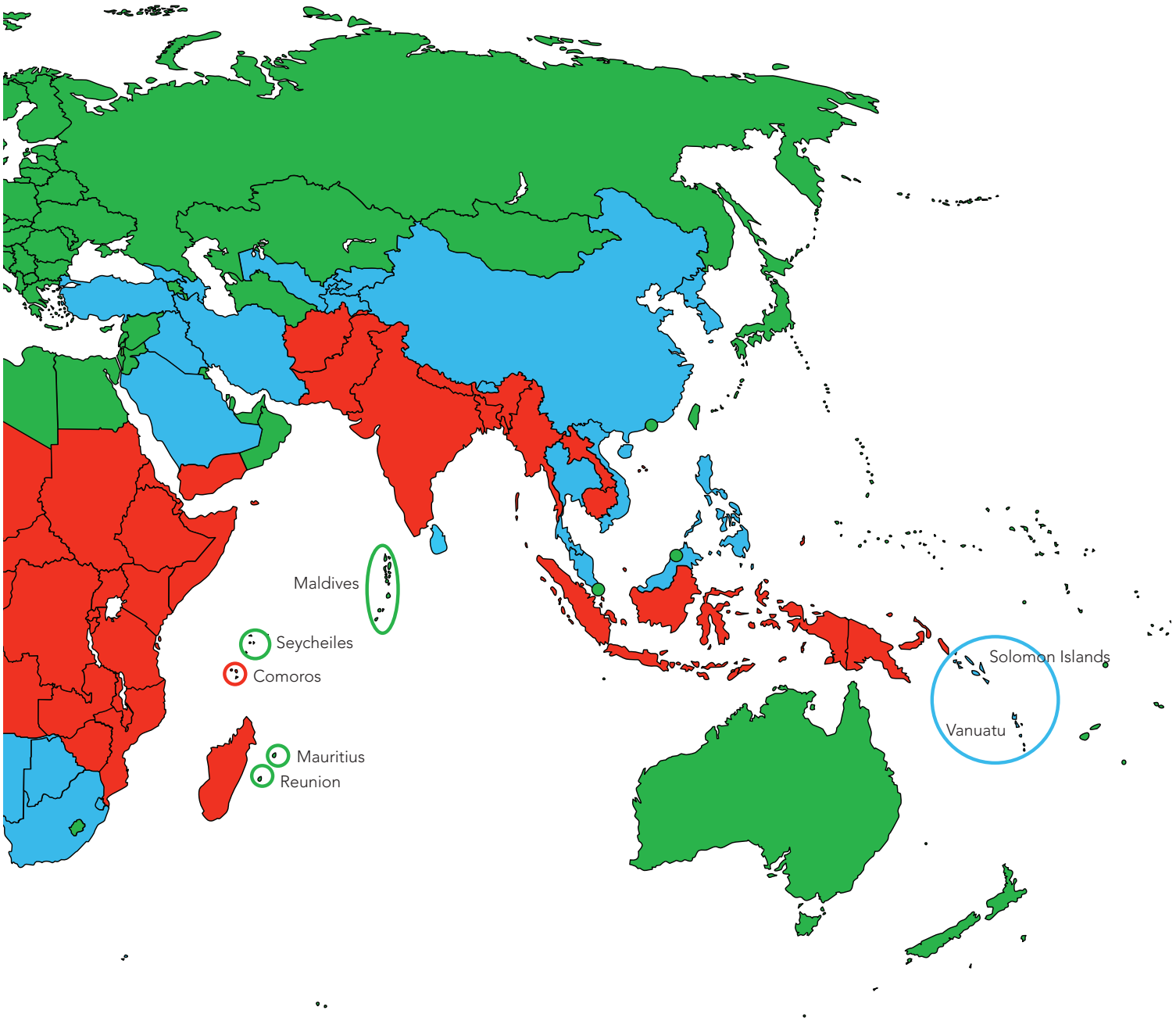
1. Feachem RG, Phillips AA, Hwang J, Cotter C, Wielgosz B, Greenwood BM, et al. Shrinking the malaria map: progress and prospects. *Lancet*. 2010; 376(9752):1566–78.
2. Feachem RG, Phillips AA, Targett G, editors. *Shrinking the Malaria Map: A Prospectus on Malaria Elimination*. San Francisco: The Global Health Group, Global Health Sciences, University of California, San Francisco; 2009.
3. Hay SI, Guerra CA, Tatem AJ, Noor AM, Snow RW. The global distribution and population at risk of malaria: past, present, and future. *Lancet Infect Dis*. 2004; 4(6):327–36.
4. WHO. World Malaria Report 2010. Geneva: World Health Organization; 2010.
5. MEG. Malaria Elimination Group. 2011 [Available from: www.malariaeliminationgroup.org]
6. The World Bank. World Development Indicators database. 2010 [cited 2011 August 20]; Available from: http://data.worldbank.org/
7. Price RN, Tjitra E, Guerra CA, Yeung S, White NJ, Anstey NM. Vivax malaria: neglected and not benign. *Am J Trop Med Hyg*. 2007; 77(6 Suppl):79–87.
8. Baird JK. Resistance to therapies for infection by *Plasmodium vivax*. *Clin Microbiol Rev*. 2009; 22(3):508–34.
9. Yangzom T. Cross-border & Regional Collaboration in Bhutan. Presentation at the 3rd annual Asia Pacific Malaria Elimination Network Meeting, Sabah, Malaysia; 2011.
10. WHO/AFRO. WHO Namibia and Angola welcomes historical cross border agreement to close the net on malaria. 2011 [cited 2011 September 1]; Available from: http://www.afro.who.int/en/namibia/press-materials/2918-who-namibia-and-angola-welcomes-historical-cross-border-agreement-to-close-the-net-on-malaria.html
11. PAHO/WHO. Argentina: Report on the situation of malaria in the Americas, 2008. 2011 [cited 2011 September 1]; Available from: http://new.paho.org/hq/dmdocuments/2011/Malaria_Report_2008_Eng_Argentina.pdf
12. Matthys B, Sherkanov T, Karimov SS, Khabirov Z, Mostowlansky T, Utzinger J, et al. History of malaria control in Tajikistan and rapid malaria appraisal in an agro-ecological setting. *Malar J*. 2008; 7:217.
13. Moonen B, Cohen JM, Snow RW, Slutsker L, Drakeley C, Smith DL, et al. Operational strategies to achieve and maintain malaria elimination. *Lancet*. 2010; 376(9752):1592–603.
14. Feachem RGA, The Malaria Elimination Group. *Shrinking the Malaria Map: A Guide on Malaria Elimination for Policy Makers*. San Francisco: The Global Health Group Global Health Sciences University of California, San Francisco; 2009.
15. MOZIZA. Mozambique, Zimbabwe and South Africa (MOZIZA) cross-border malaria initiative. The Global Fund to Fight AIDS, Tuberculosis and Malaria R10 proposal; 2010.
16. Tang L. Cross Border Collaboration on Malaria Elimination—China/Myanmar. Presentation at the 3rd annual Asia Pacific Malaria Elimination Network Meeting, Sabah, Malaysia; 2011.
17. IRIN. Saudi Arabia—Yemen: Anti-malaria campaign targets border areas. 2008 [cited 2011 September 1]; Available from: http://www.irinnews.org/report.aspx?reportid=77125
18. WHO/EMRO. Technical discussion on malaria elimination in the Eastern Mediterranean Region: vision, requirements and strategic outline: World Health Organization Regional Office for the Eastern Mediterranean Region; 2008.
19. Bilton N. H.P. tests mobile technology in fight against malaria. 2011 [cited 2011 September 2]; Available from: http://bits.blogs.nytimes.com/2011/06/06/h-p-tests-mobile-phones-in-fight-against-malaria/
20. Kelly GC, Hii J, Batarii W, Donald W, Hale E, Nausien J, et al. Modern geographical reconnaissance of target populations in malaria elimination zones. *Malar J*. 2010; 9:289.
21. Resultados del proyecto DDT/GEF/OPS/OMS en El Salvador [Powerpoint presentation]. Mexico: Pan American Health Organization; 2008.
22. Dondorp AM, Yeung S, White L, Nguon C, Day NP, Socheat D, et al. Artemisinin resistance: current status and scenarios for containment. *Nat Rev Microbiol*. 2010; 8(4):272–80.

23. Price RN, Douglas NM, Anstey NM. New developments in *Plasmodium vivax* malaria: severe disease and the rise of chloroquine resistance. *Curr Opin Infect Dis.* 2009; 22(5):430–5.
24. WHO. Global report on antimalarial drug efficacy and drug resistance: 2000–2010. Geneva: World Health Organization; 2010.
25. Maude RJ, Pontavornpinyo W, Saralamba S, Aguas R, Yeung S, Dondorp AM, et al. The last man standing is the most resistant: eliminating artemisinin-resistant malaria in Cambodia. *Malar J.* 2009; 8:31.
26. WWARN. Worldwide Antimalarial Resistance Network. 2011 [cited 2011 August 22]; Available from: http://www.wwarn.org/
27. Sabot O, Cohen JM, Hsiang MS, Kahn JG, Basu S, Tang L, et al. Costs and financial feasibility of malaria elimination. *Lancet* 2010; 376(9752):1604–15.
28. Smith DL, Cohen JM, Moonen B, Tatem AJ, Sabot OJ, Ali A, et al. Infectious disease. Solving the Sisyphean problem of malaria in Zanzibar. *Science* 2011; 332(6036):1384–5.
29. Menach AL, Tatem AJ, Cohen JM, Hay SI, Randell H, Patil AP, et al. Travel risk, malaria importation and malaria transmission in Zanzibar. *Scientific Reports* 2011; 1(93).
30. Dutt AK, Dutta HM, Parera C. Resurgence of Malaria in Sri Lanka in the 1970s. In: Akhtar R, Dutt AK, Wadhwa V, editors. Adv Asian Human-Env Res: Malar South Asia. New York: Springer Science and Business Media; 2010. p. 29–41.
31. Roberts DR, Manguin S, Mouchet J. DDT house spraying and re-emerging malaria. *Lancet* 2000; 356(9226):330–2.
32. Ruberu PS. Economic justification of intensive malaria control programme in Sri Lanka. Unpublished manuscript; 1977.
33. Tatarsky A, Aboobakar S, Cohen JM, Gopee N, Bheecarry A, Moonasar D, et al. Preventing the reintroduction of malaria in mauritius: a programmatic and financial assessment. *PLoS One* 2011; 6(9):e23832.

Malaria-free, Eliminating and Controlling Countries, 2011



Map Source: Malaria Elimination Initiative (2011) The Global Health Group, University of California, San Francisco


Maldives
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Mauritius
Reunion
Solomon Islands
Vanuatu

Methods and Sources for Preparing Maps and Country Profiles

This section describes the methods used for preparing the data and maps presented in the country profiles. Many of these maps have been published in peer-reviewed literature. Some maps have been updated and are being presented here for the first time to include more recent data where they have been identified. Sources for the peer-reviewed publications (for further reading) can be found in the reference section below and in the Appendix of the *Atlas*.

Overview

Malaria at a Glance

Data presented in the Malaria at a Glance box was gathered from the World Health Organization (WHO) World Malaria Report 2010.(1) Unless otherwise noted, all data reported are for 2009. Reported cases of malaria are calculated minus any known imported malaria cases to reflect only indigenous cases. The percentage of population-at-risk is calculated by dividing the total number of people at risk of malaria by the total country population estimates for 2009, as identified in the World Development Indicators online statistical database (2), which is published by the World Bank. Annual parasite index (API) and slide positivity rate (SPR) were calculated using the data provided in the annex of the WHO World Malaria Report 2010. Annual parasite index is presented as reported malaria cases per thousand of the total population per year. Slide positivity rate is presented as the percentage of positive microscopy slides divided by the total number of slides obtained.

Reported Malaria Cases

The graph of Reported Malaria Cases for the years 2000–2009 is plotted using the data provided in the annex of the WHO World Malaria Report 2010.(1)

Health and Economic Indicators

Data presented in the Health and Economic Indicators box was gathered from the online World Development Indicators database for 2010.(2) Figures are presented in United States dollars (US$). Private health expenditure is calculated by subtracting the percentage of public health expenditure from total health expenditure.

Strategic Program Goals for Elimination

All national and subnational Strategic Program Goals for Elimination are gathered through a variety of online sources such as Global Fund proposals, national malaria documents and strategic elimination plans, peer-reviewed literature, and international malaria meeting presentations. Sources for these strategic program goals, where identified, are listed in Appendix A. Note that the program goals identified in this section were collected between June 2010 and September 2011 from the best information available. Strategic program goals may have been updated; those changes may not be accurately reflected in this *Atlas*.

Maps

Each of the maps contained within this document are oriented north (up) and have a scale bar in kilometers (1 kilometer = 0.6 mile).

Human Population Density

The Human Population Density maps represent the population count per km^2 in 2010. The maps are generated using the Global Rural Urban Mapping Project (GRUMP) beta version (3) of gridded population counts at 1 x 1 km globally for the year 2000 and an ancillary surface of urban extents. These were projected to the year 2010 by applying national, urban, and rural specific growth rates (4) to the relevant areas and adjusting national totals to match the United Nations' estimates. This resulted in the 2010 population count surface shown, which was used to derive the population totals.

Transmission Limits

Malaria risk was first defined using Annual Parasite Incidence (API) data for each administrative unit averaged over the most recent four years for which data were available (as detailed in Appendix B). Risk was stratified into *Plasmodium falciparum*- or *Plasmodium vivax*-free, unstable transmission of <0.1 case per 1,000 population (API) and stable transmission of ≥0.1 case per 1,000 population (API). Where sufficient data were available, stable risk was further stratified into low stable transmission (≥0.1 case and <1.0 case per 1,000 population) and stable transmission (≥1.0 case per 1,000 population). The additional category of risk of low stable transmission has been introduced as it confers with the WHO cutoff for countries entering the elimination phase of malaria control. As more data becomes available, this new category will appear in future iterations of the *Atlas*. The transmission limits were then further refined using temperature and aridity data. Locations were classified as zero risk where the average temperature profile did not allow a window of time throughout the year for transmission to take place. Risk at locations that were identified as being extremely arid (bare areas) were down-regulated by one class, i.e., stable transmission areas were reclassified as unstable transmission, and unstable transmission areas were reclassified as no-risk. Data from international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands, and other administrative areas.(5) Full details can be found in two publications on *P. falciparum* transmission (5) and *P. vivax* transmission.(6)

Occurrence of Malaria Vector Species

An extensive literature review of the habits and behavior of each of the dominant malaria vector species was used to generate the Bionomics Vector Species Tables. Each table summarizes key characteristics of all the vectors believed to be present in a country. A vector map is presented for each of the vectors considered to be most important in malaria transmission in that country. The Occurrence of Malaria Vector Species maps show, by single species, the predicted probability of occurrence of that species. Boosted Regression Tree models, using expert opinion ranges combined with actual occurrence data and environmental and climatic variables, were used to predict the probability that a species occurs at each location. Full details can be found in a series of papers on the Asia-Pacific (7), Africa, Europe and the Middle-East (8) And the Americas.(9) Within the Bionomics Vector Species Tables, the 'zoophilic/anthropophilic' field lists preferences for feeding on animals or humans, respectively. The 'endo/exophagic' field lists preferences for feeding indoors or outside, respectively. The 'endo/exophilic' field lists preferences for resting indoors or outside, respectively.

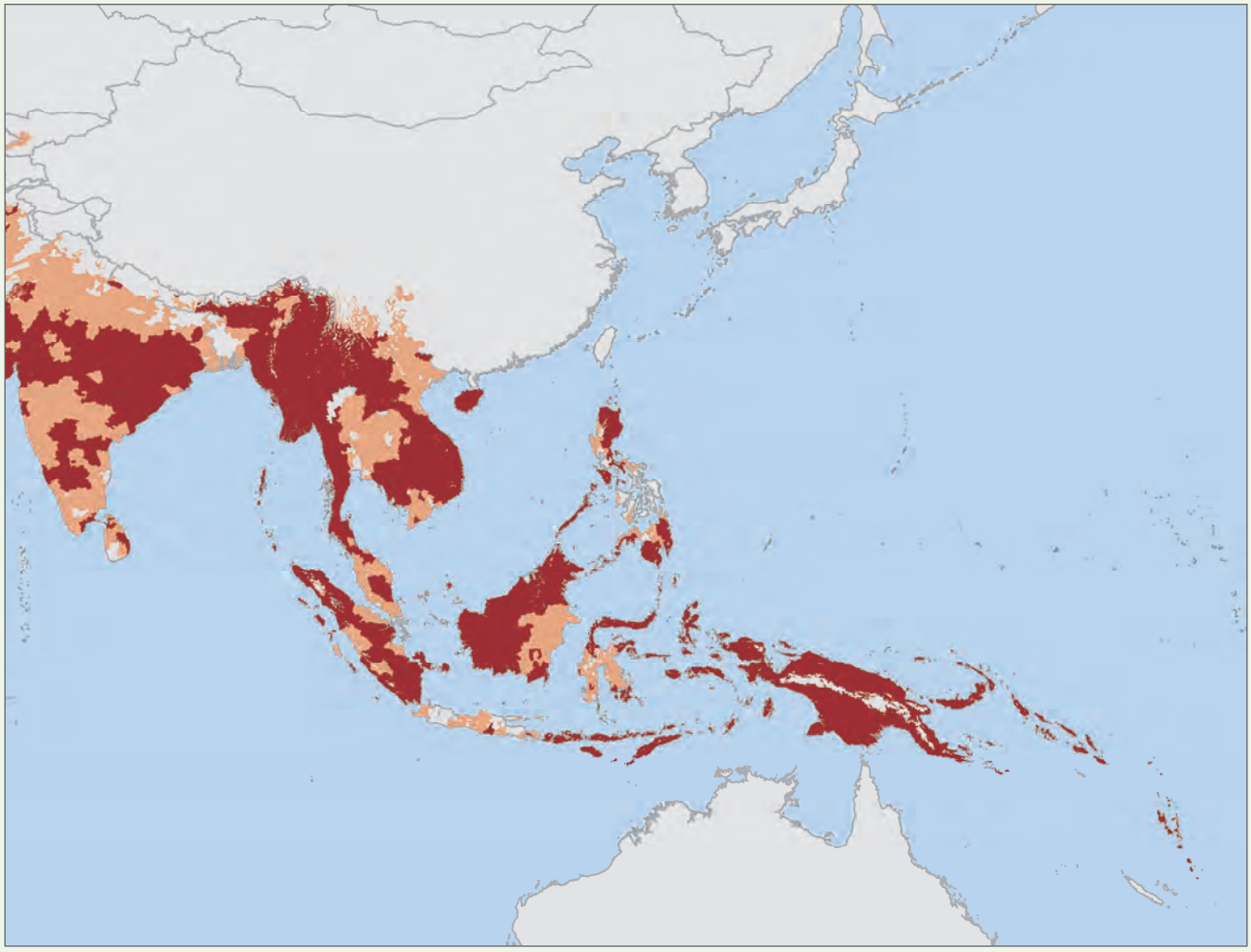
References

1. WHO. World Malaria Report 2010. Geneva: World Health Organization, 2010. http://www.who.int/malaria/world_malaria_report_2010/worldmalariareport2010.pdf.
2. The World Bank. World Development Indicators online. Geneva: The World Bank, 2011. http://data.worldbank.org/.
3. Socioeconomic Data and Applications Center (SEDAC). http://sedac.ciesin.columbia.edu/gpw.
4. United Nations Department of Economics and Social Affairs. World Urbanization Prospects: The 2007 Revision Population Database. http://esa.un.org/unup.
5. Guerra, CA, Gikandi, PW, Tatem, AJ, Noor, AM, Smith, DL, Hay, SI and Snow, RW. (2008). The limits and intensity of *Plasmodium falciparum* transmission: implications for malaria control and elimination worldwide. *Public Library of Science Medicine*, 5(2): e38.
6. Guerra, CA, Howes, RE, Patil, AP, Gething, PW, Van Boeckel, TP, Temperley, WH, Kabaria, CW, Tatem, AJ, Manh, BH, Elyazar, IRF, Baird, JK, Snow, RW and Hay, SI. (2010). The international limits and population at risk of *Plasmodium vivax* transmission in 2009. *Public Library of Science Neglected Tropical Diseases*, 4(8): e774.
7. Sinka, ME, Bangs, MJ, Manguin, S, Chareonviriyaphap, T, Patil, AP, Temperley, WH, Gething, PW, Elyazar, IRF, Kabaria, CW, Harbach, RE and Hay, SI. (2011). The dominant Anopheles vectors of human malaria in the Asia-Pacific region: occurrence data, distribution maps and bionomic précis. *Parasites and Vectors* 4:89.
8. Sinka, ME, Bangs, MJ, Manguin, S, Coetzee, M, Mbogo, CM, Hemingway, J, Patil, AP, Temperley, WH, Gething, PW, Kabaria, CW, Okara, RM, Boeckel, TV, Godfray, HCJ, Harbach, RE and Hay, SI. (2010). The dominant Anopheles vectors of human malaria in Africa, Europe and the Middle East: occurrence data, distribution maps and bionomic précis. *Parasites & Vectors*, 3:117.
9. Sinka, ME, Rubio-Palis, Y, Manguin, S, Patil, AP, Temperley, WH, Gething, PW, Van Boeckel, TP, Kabaria, CW, Harbach, RE and Hay, SI. (2010). The dominant Anopheles vectors of human malaria in the Americas: occurrence data, distribution maps and bionomic précis. *Parasites & Vectors*, 3:72.

Asia Pacific

Bhutan | China | Democratic People's Republic of Korea
Malaysia | Philippines | Republic of Korea | Solomon Islands
Sri Lanka | Thailand | Vanuatu | Vietnam

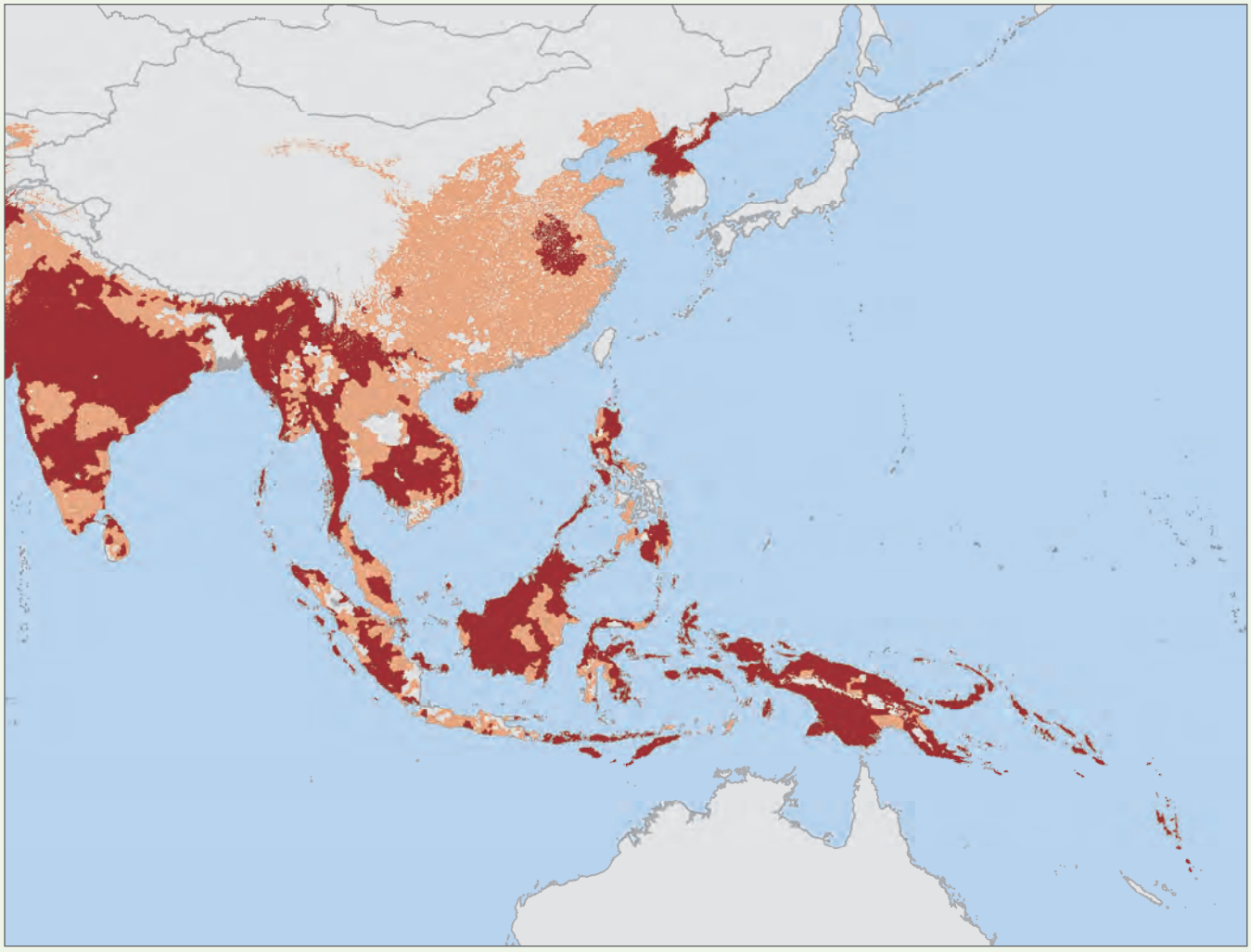
Malaria Transmission Limits for *Plasmodium falciparum*



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

Malaria Transmission Limits for *Plasmodium vivax*



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

BHUTAN

Overview

Malaria at a Glance

Reported cases of malaria (56% *P. falciparum*)	972
Deaths from malaria	4
Population at risk (%) (Total population: 708,484)	73
Annual parasite index (cases/1,000 total population/year)	1.4
Slide positivity rate (%)	1.6

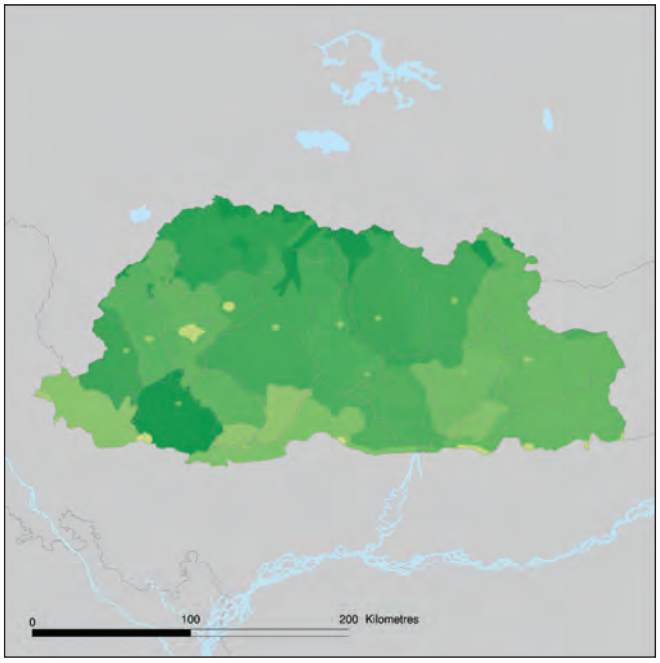
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,920
Country income level	Lower middle
Annual per capita health expenditure (US$)	98
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	18
Life expectancy (years)	67

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

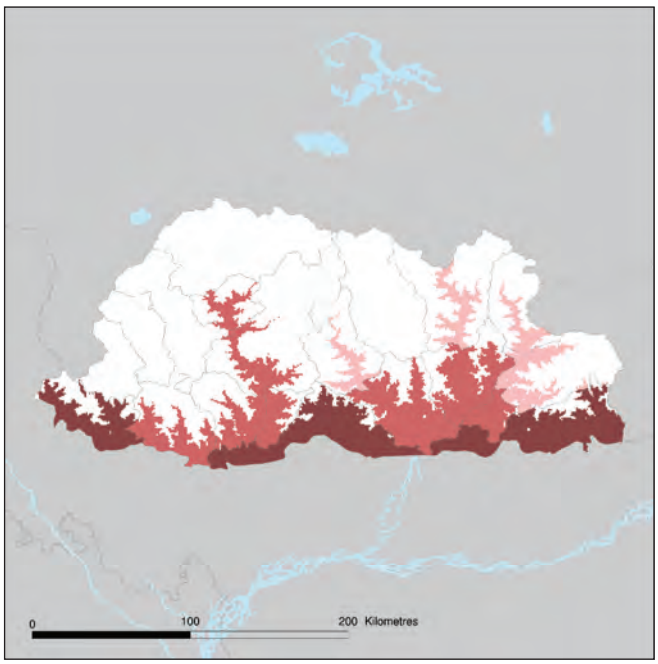
Water

Strategic Program Goals for Elimination

- Achieve zero local transmission of malaria in Bhutan by 2016
- Zero deaths due to malaria by 2016
- World Health Organization certification of malaria free status by 2020

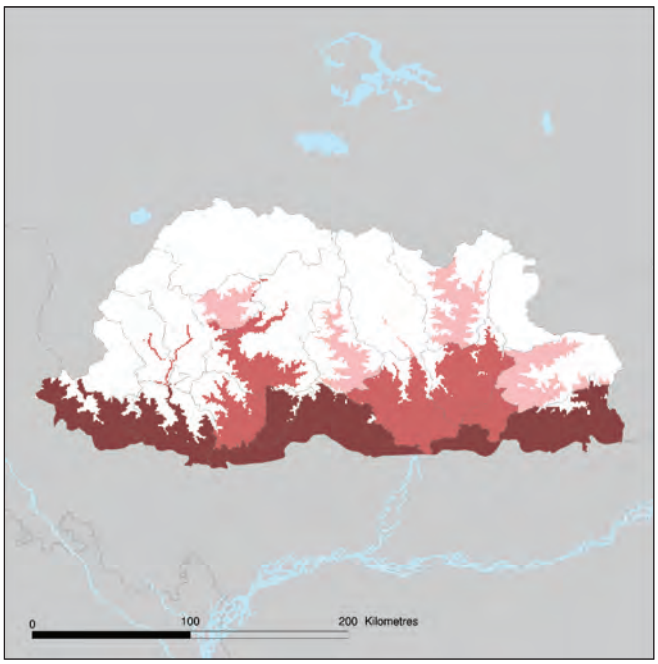
Malaria Transmission Limits

Plasmodium falciparum



- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

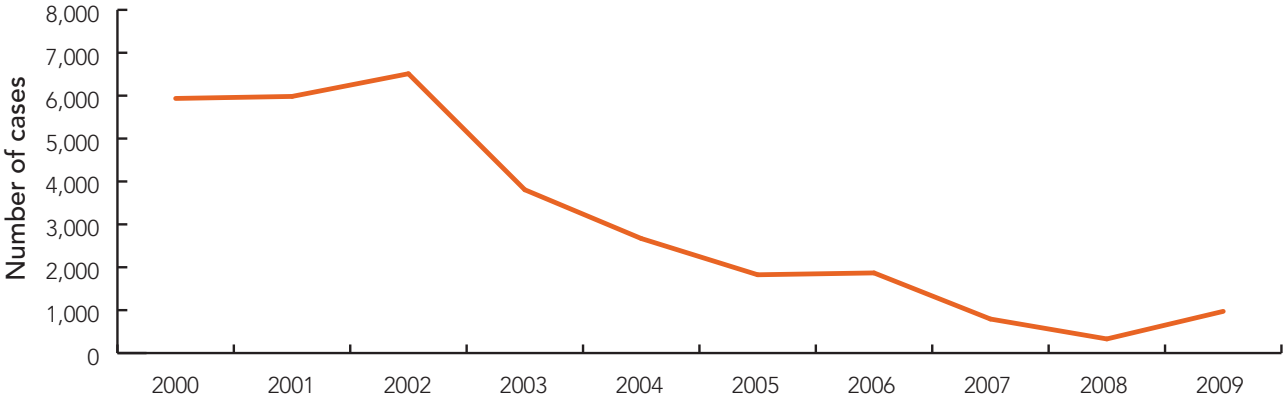
Plasmodium vivax



- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

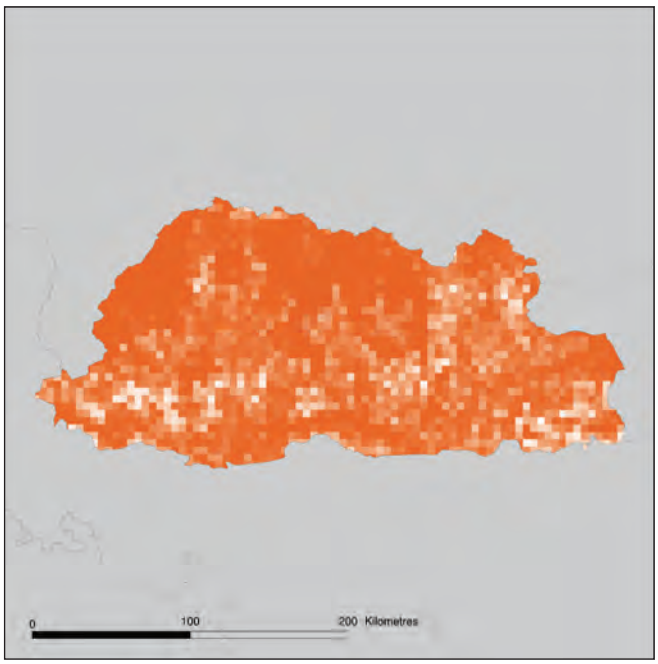
Reported Malaria Cases



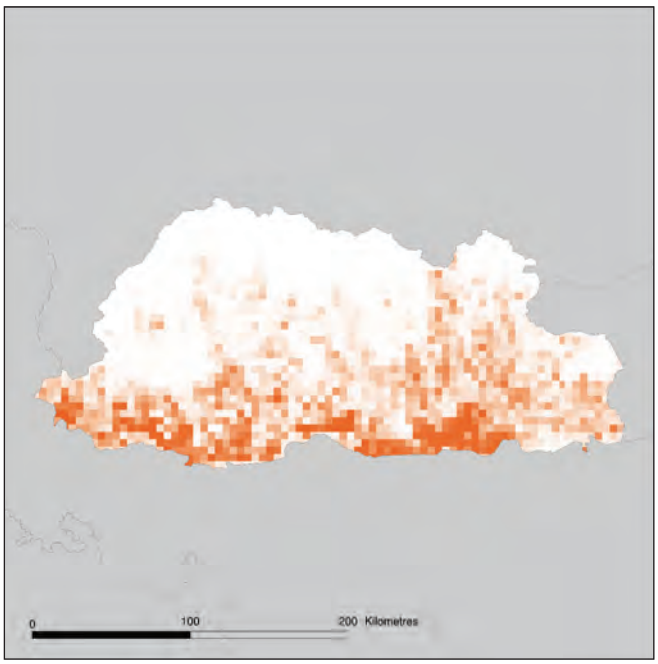
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles sinensis*



2. *Anopheles aconitus*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) sinensis species complex	Variable depending on location	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	From coastal plains to upland rice fields	Zoophilic	Both	Exophilic/both	Dusk/ night

CHINA

Overview

Malaria at a Glance

Reported cases of malaria (88% *P. vivax*)	9,287
Deaths from malaria	12
Population at risk (%) (Total population: 1.3 billion)	52
Annual parasite index (cases/1,000 total population/year)	0.01
Slide positivity rate (%)	0.2

Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	4,260
Country income level	Upper middle
Annual per capita health expenditure (US$)	177
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	50
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density

Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goals for Elimination

- By 2015, no indigenous cases nationally except in Yunnan province along the China-Myanmar border
- National malaria elimination by 2020

Malaria Transmission Limits

Plasmodium falciparum

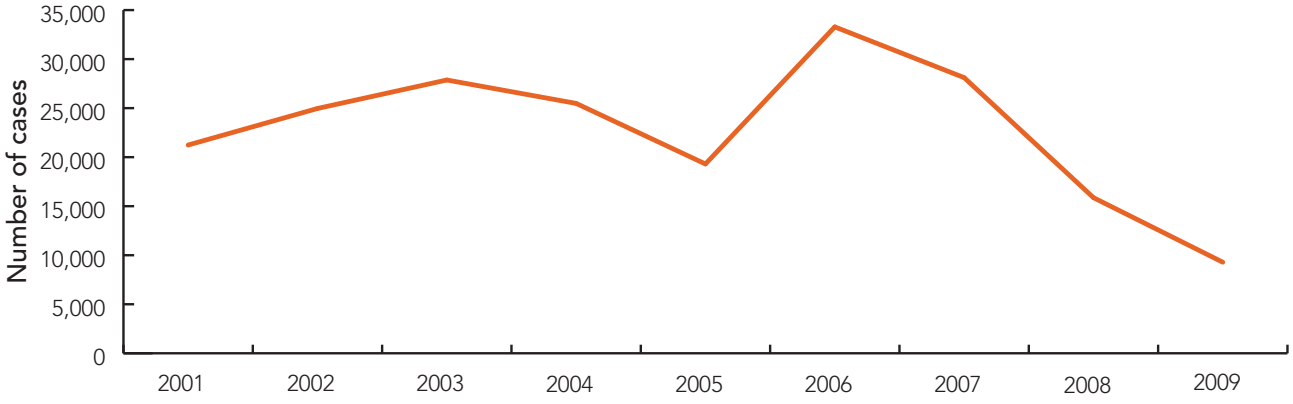
Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

Plasmodium vivax

Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/*P. vivax* malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. Dirus Complex

2. Minimus Complex

Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

3. *Anopheles lesteri*

4. Maculatus Group

5. *Anopheles sinensis*

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) dirus species complex	Includes highly competent vector species	Forested mountains and foothills, cultivated forests, plantations and forest fringes	Anthropophilic	Both	Exophilic	Night
Anopheles (Cellia) minimus species complex	Important malaria vectors	Forested hills, agricultural fields including traditional rice agro-ecosystems, 200–900m	Both	Both	Both	Dusk/ night
Anopheles (Anopheles) lesteri Baisas & Hu, 1936	Important vector in Eastern, Central and Southern China	Cool shady places, hills and grassy fields, fresh-water pools	Both	Data not available	Endophilic	Dusk/ night
Anopheles (Cellia) maculatus Group	Variable depending on species and location	Hilly and mountainous areas, permanent or semi-permanent clean water bodies of sunlit water	Zoophilic/both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) sinensis species complex	Important vector of *P. vivax* malaria in China	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	From coastal plains to upland rice fields	Zoophilic	Both	Exophilic/ both	Dusk/ night
Anopheles (Cellia) annularis van der Wulp, 1884; *Anopheles (Anopheles) barbirostris* species complex; *Anopheles (Cellia) culicifacies* species complex	Present but non or minor vector in China					

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	14,322
Deaths from malaria	N/A
Population at risk (%) (Total population: 23.8 million)	49
Annual parasite index (cases/1,000 total population/year)	0.6
Slide positivity rate (%)	N/A

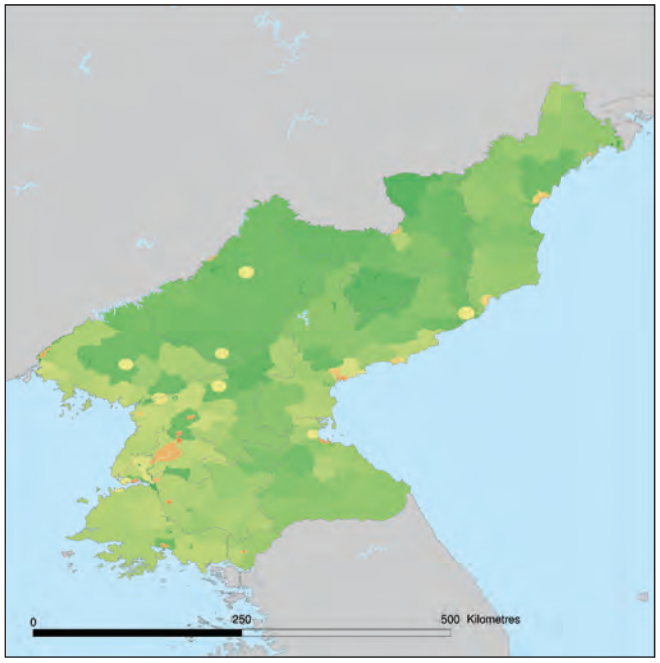
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	555
Country income level	Low
Annual per capita health expenditure (US$)	1
Total health expenditure as % of GDP	3
Private health expenditure as % of total health expenditure	14
Life expectancy (years)	67

Sources: WHO, World Health Statistics 2009; World Bank, World Development Indicators; United Nations Statistics Division

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

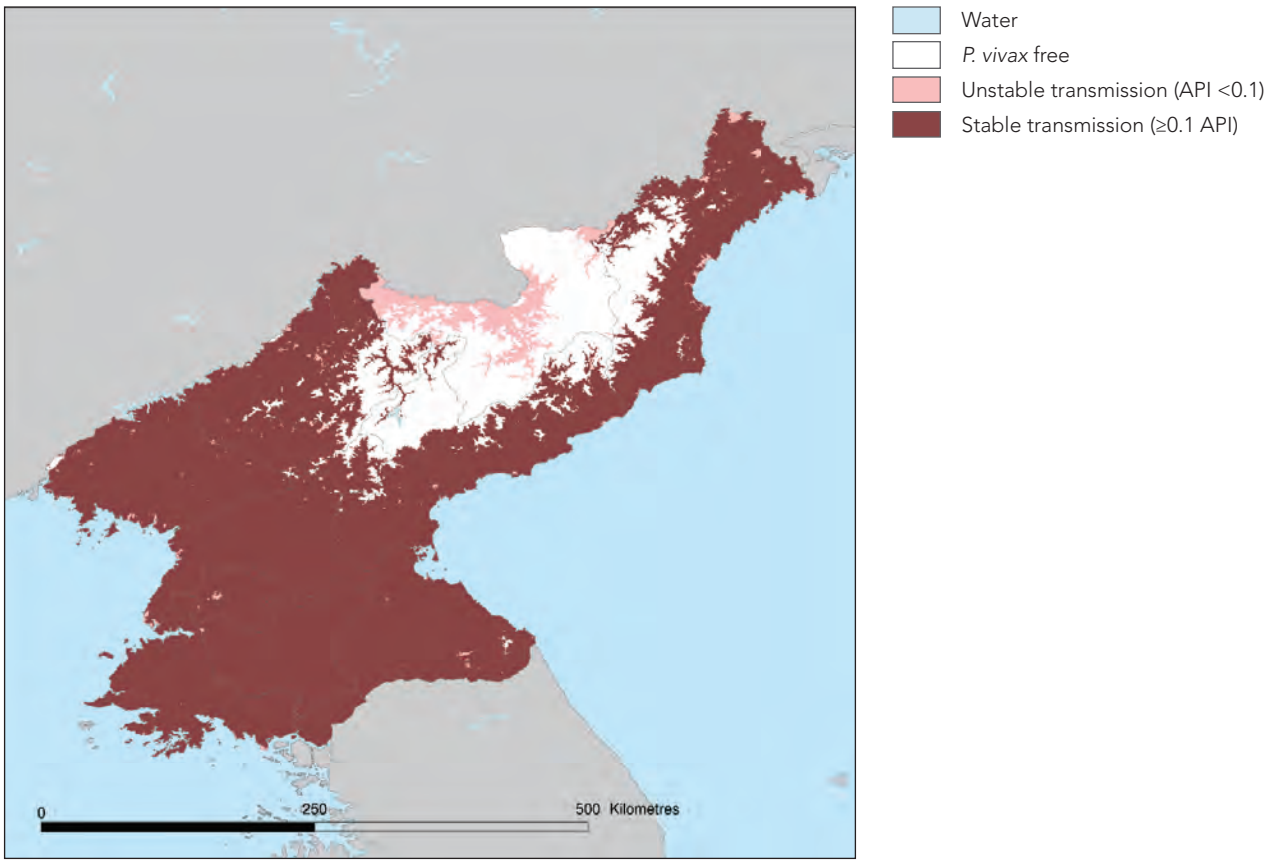
Water

Strategic Program Goals for Elimination

- By 2012, reduce overall malaria morbidity by 50% of the level in 2007
- By 2012, reduce malaria morbidity in the higher transmission zone by 70% of the level in 2007

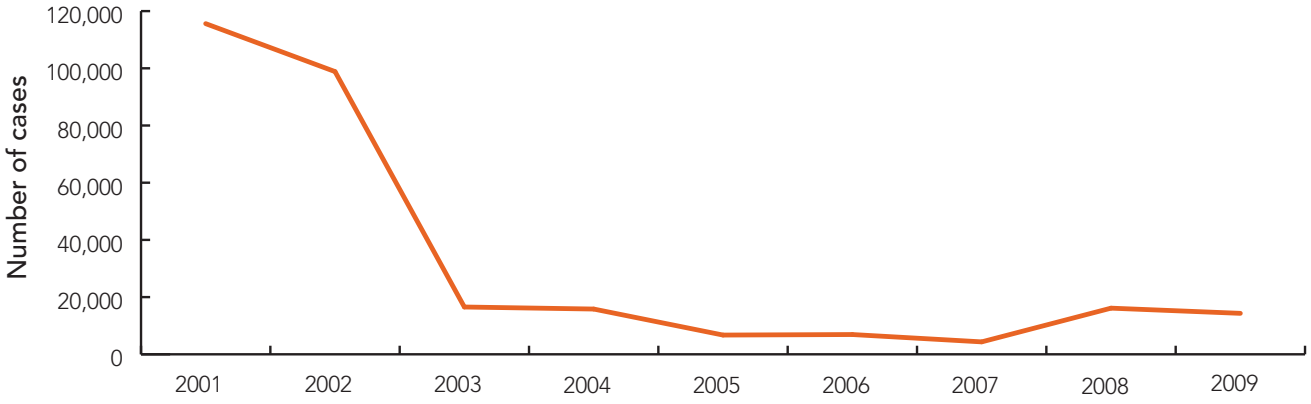
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

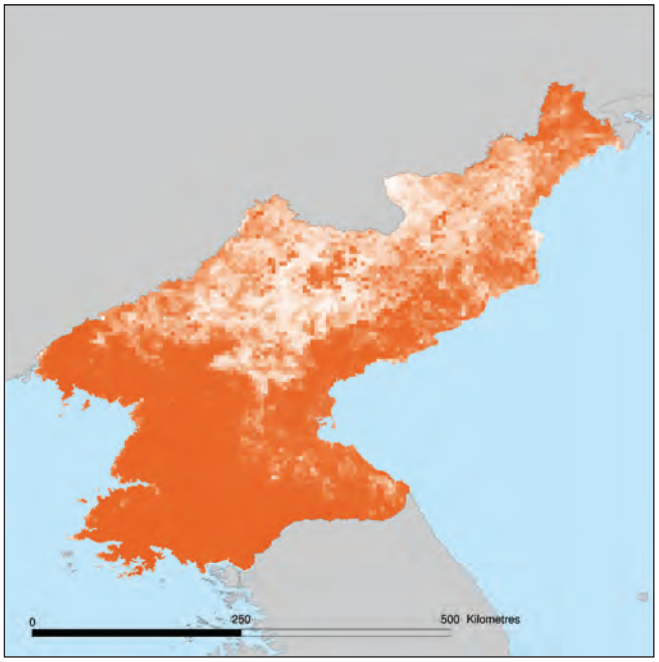
Reported Malaria Cases



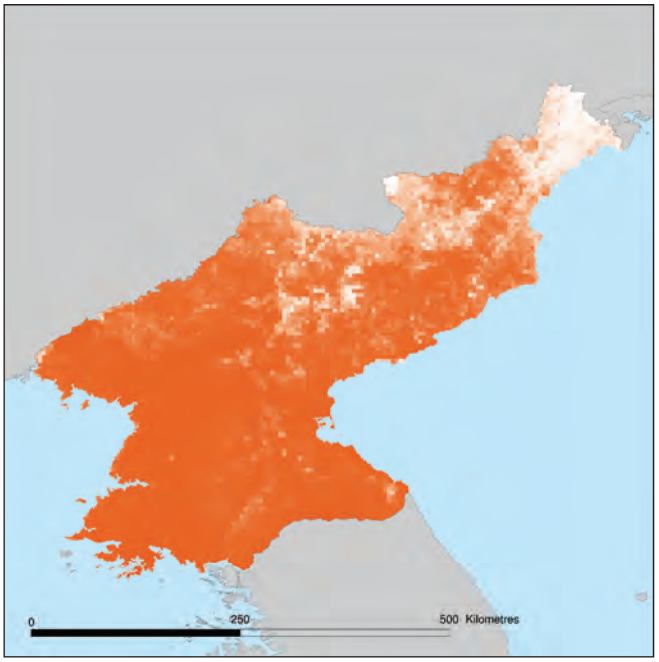
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles sinensis*



2. *Anopheles lesteri*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) sinensis species complex	Important vector of *P. vivax* malaria	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Anopheles) lesteri Baisas & Hu, 1936	Important vector	Cool shady places, hills and grassy fields, fresh-water pools	Both	Data not available	Endophilic	Dusk/ night

MALAYSIA

Overview

Malaria at a Glance

Reported cases of malaria (53% *P. vivax*)	6,426
Deaths from malaria	N/A
Population at risk (%) (Total population: 27.9 million)	4
Annual parasite index (cases/1,000 total population/year)	0.2
Slide positivity rate (%)	0.4

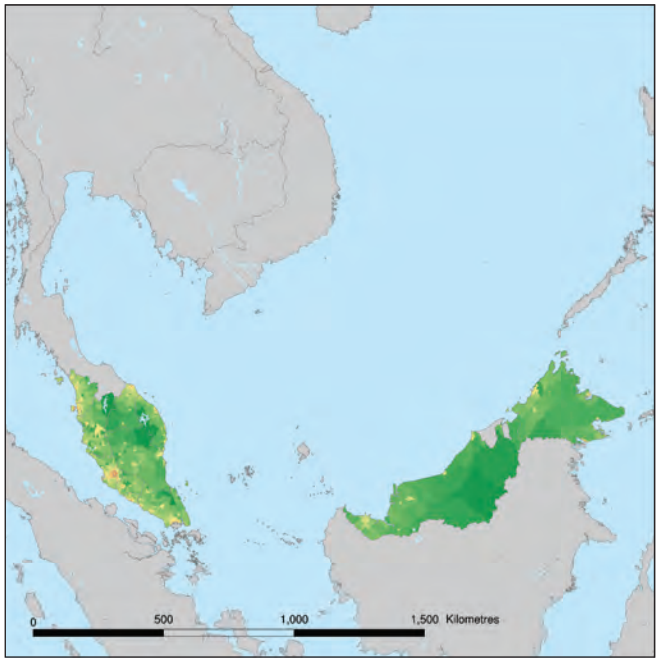
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	7,900
Country income level	Upper middle
Annual per capita health expenditure (US$)	336
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	55
Life expectancy (years)	75

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

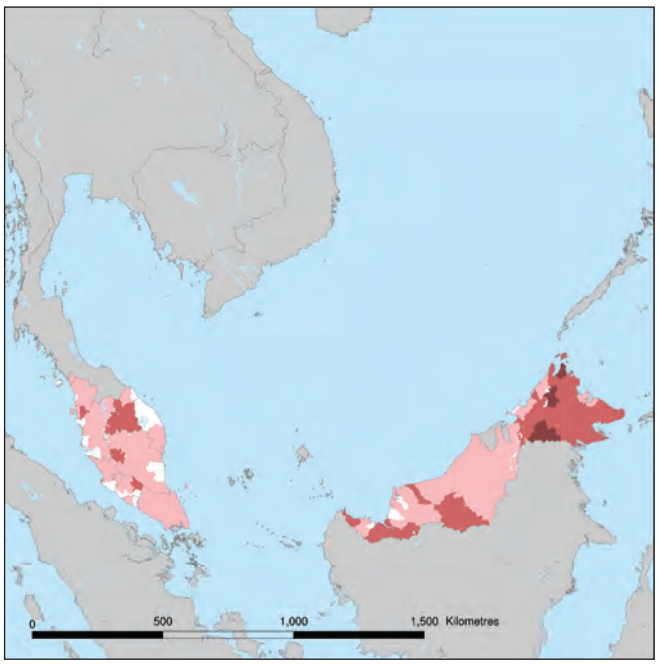
Water

Strategic Program Goals for Elimination

- Elimination of malaria in Peninsular Malaysia by 2015
- Elimination of malaria in Malaysian Borneo by 2020

Malaria Transmission Limits

Plasmodium falciparum



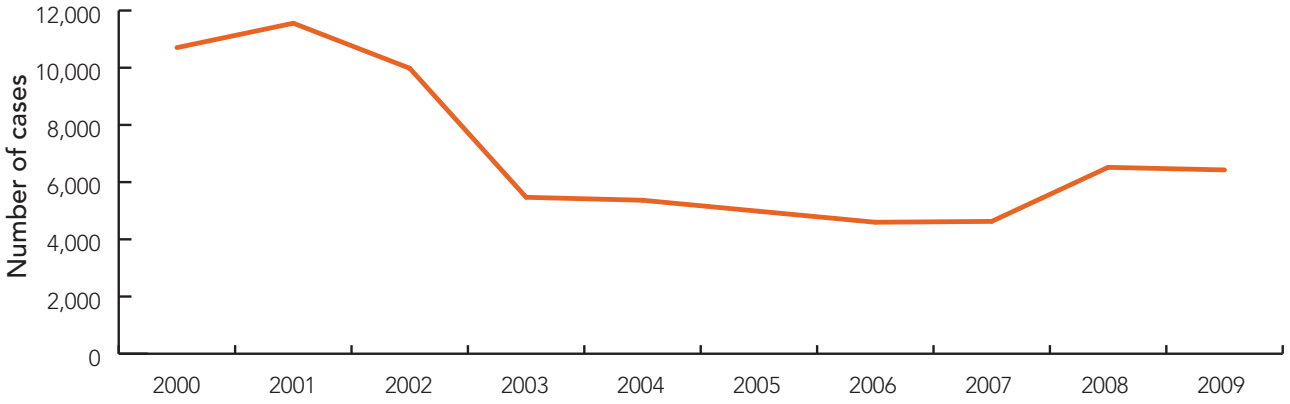
- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

Plasmodium vivax

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles balabacensis*

2. Maculatus Group

3. Sundaicus Complex

Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) balabacensis Baisas, 1936	Variable depending on location	Forested areas, shaded temporary pools	Anthropophilic	Both	Both	Dusk/ night
Anopheles (Cellia) maculatus Group	Variable depending on species and location	Hilly and mountainous areas, permanent or semi-permanent clean water bodies of sunlit water	Zoophilic/both	Both	Exophilic	Dusk/ night
Anopheles (Cellia) sundaicus species complex	Variable depending on location	Open mangrove and coastal shrimp or fish ponds, inland seawater canals	Anthropophilic/ both	Both	Both	Night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	From coastal plains to upland rice fields	Zoophilic	Both	Exophilic/ both	Dusk/ night
Anopheles (Cellia) flavirostris (Ludlow, 1914)	Variable depending on location	Foothills, streams, from coastal plains to 600–1500m	Both	Both	Exophilic/ both	Night
Anopheles (Anopheles) sinensis species complex	Variable depending on location and abundance	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Cellia) subpictus species complex	Variable depending on species and location	Coastal brackish water, riverine pools and rice fields	Zoophilic	Both	Endophilic	Dusk/ night
Anopheles (Anopheles) barbirostris species complex; *Anopheles (Cellia) leucosphyrus* and *Anopheles (Celia) latens*	Present but non or minor vector in Malaysia					

PHILIPPINES

Overview

Malaria at a Glance

Reported cases of malaria (70% *P. falciparum*)	19,198
Deaths from malaria	24
Population at risk (%) (Total population: 93.6 million)	78
Annual parasite index (cases/1,000 total population/year)	0.2
Slide positivity rate (%)	5.4

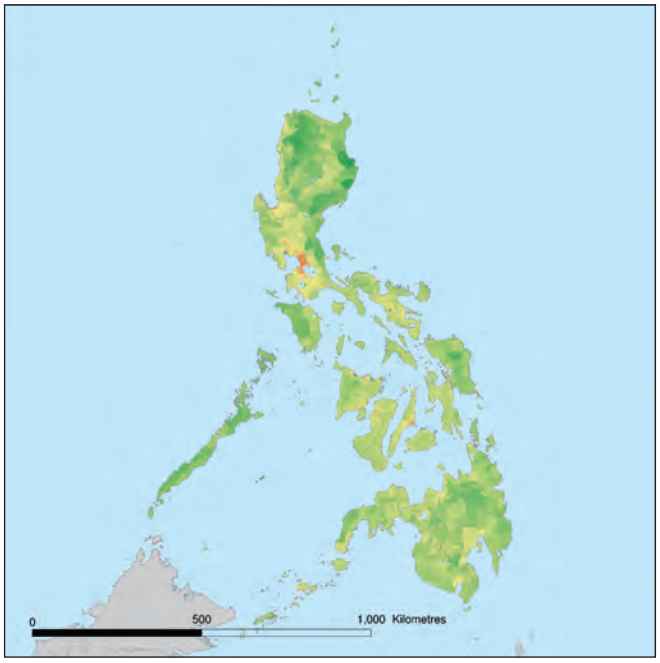
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	2,050
Country income level	Lower middle
Annual per capita health expenditure (US$)	67
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	65
Life expectancy (years)	72

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

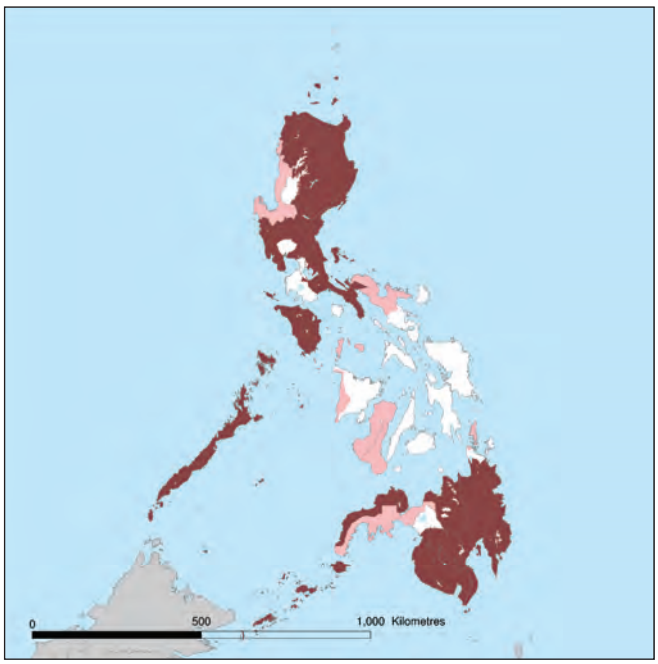
Water

Strategic Program Goals for Elimination

- By 2014, zero deaths due to malaria
- National malaria elimination by 2020

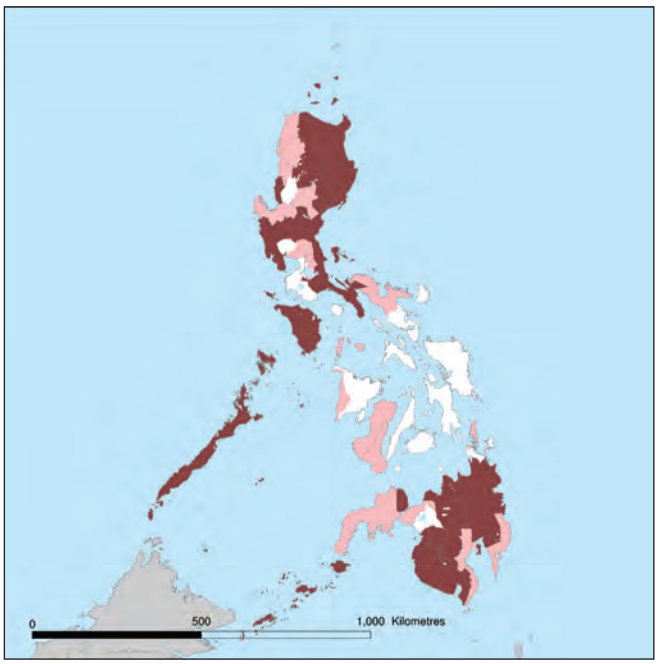
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

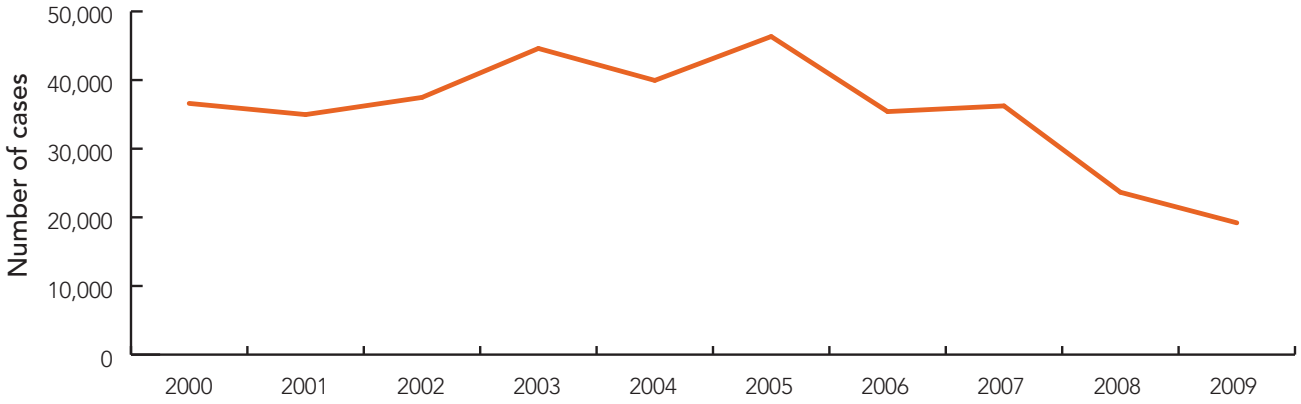
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

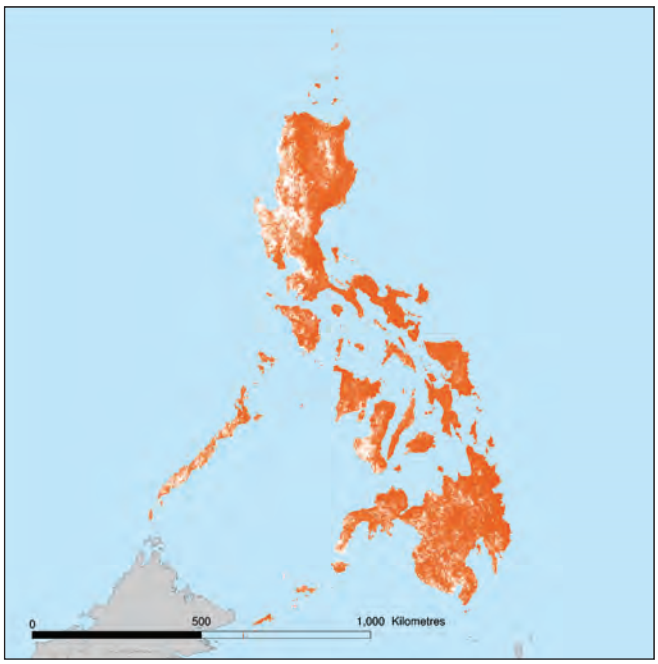
Reported Malaria Cases



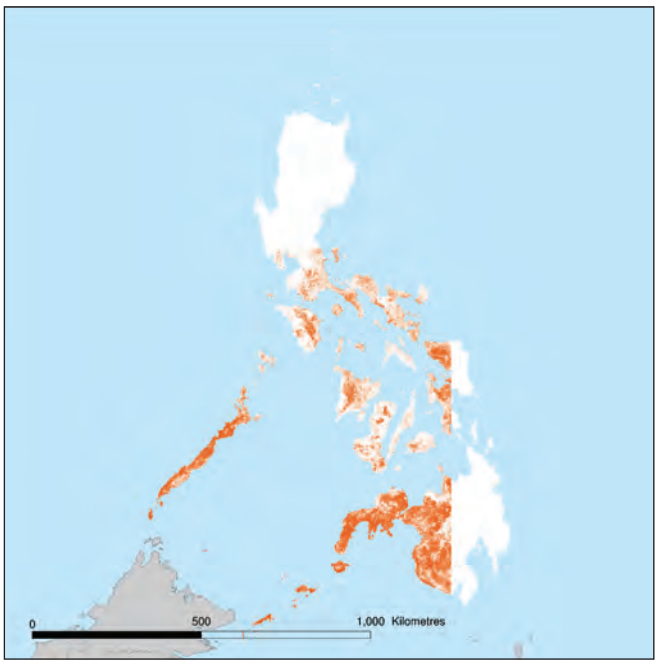
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles flavirostris*



2. *Anopheles balabacensis*



3. Maculatus Group

Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) flavirostris (Ludlow, 1914)	Important vector	Foothills, streams, from coastal plains to 600–1500m	Both	Both	Exophilic/ both	Night
Anopheles (Cellia) balabacensis Baisas, 1936	Variable depending on location	Forested areas, shaded temporary pools	Anthropophilic	Both	Both	Dusk/ night
Anopheles (Cellia) maculatus Group	Variable depending on species and location	Hilly and mountainous areas, permanent or semi-permanent clean water bodies of sunlit water	Zoophilic/both	Both	Exophilic	Dusk/ night
Anopheles (Cellia) subpictus species complex	Present but non or minor vector in the Philippines					

REPUBLIC OF KOREA

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	1,317
Deaths from malaria	N/A
Population at risk (%) (Total population: 48.9 million)	7
Annual parasite index (cases/1,000 total population/year)	0.02
Slide positivity rate (%)	N/A

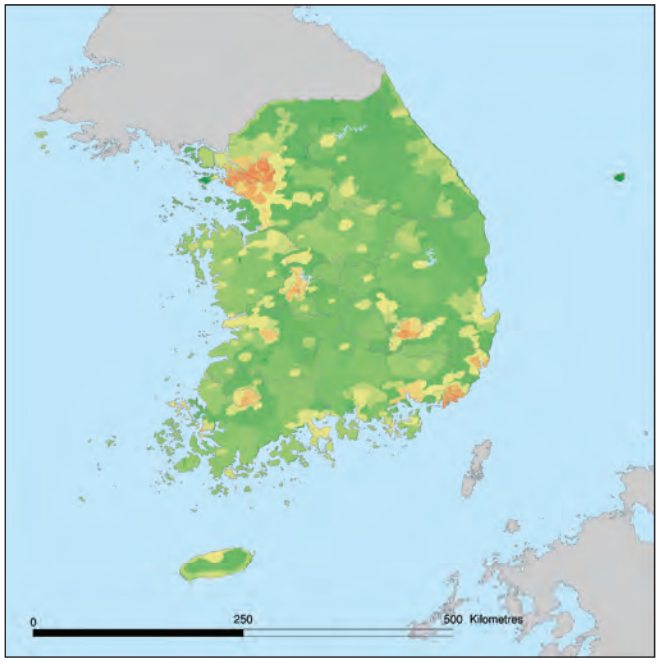
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	19,890
Country income level	High
Annual per capita health expenditure (US$)	1,108
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	46
Life expectancy (years)	80

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

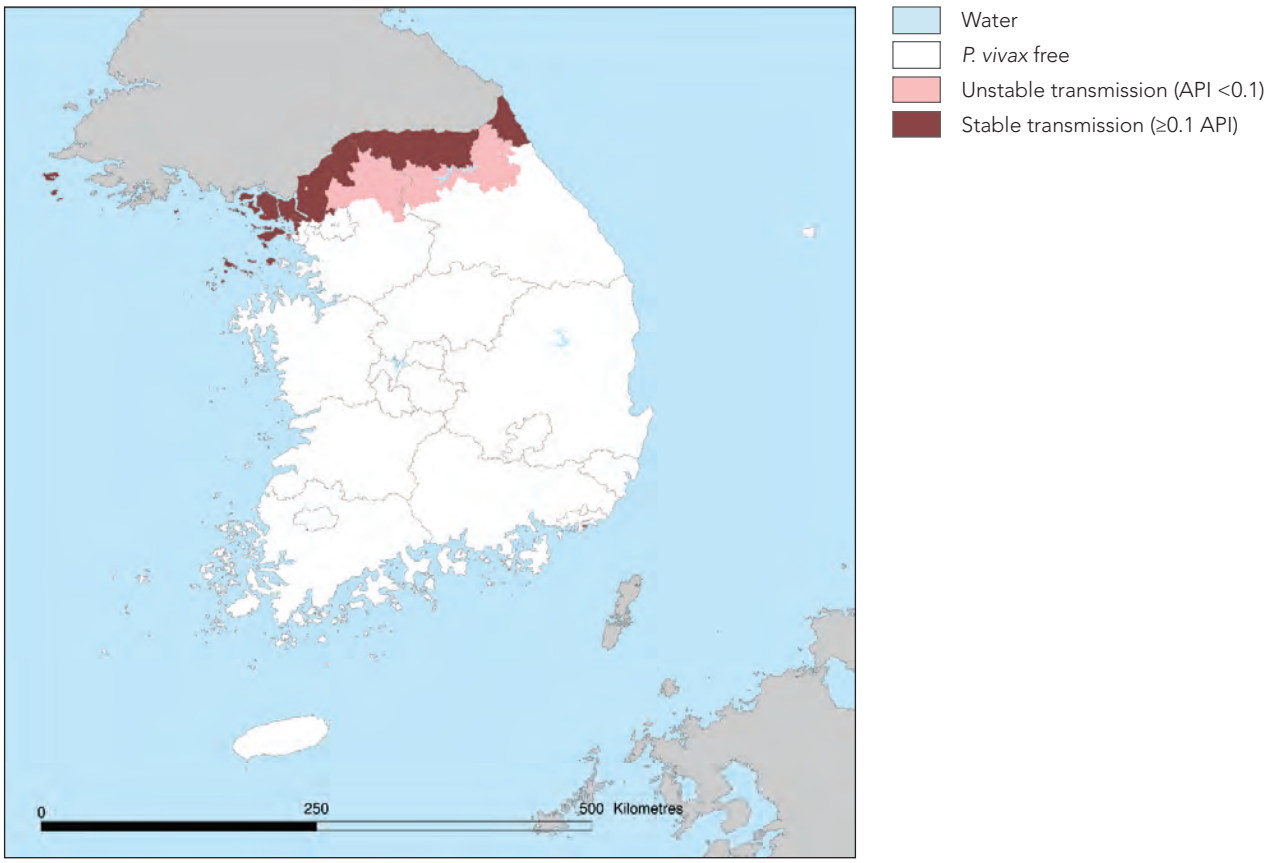
Water

Strategic Program Goals for Elimination

- Reduce malaria incidence annually by 25% from 2010–2015
- National malaria elimination by 2015

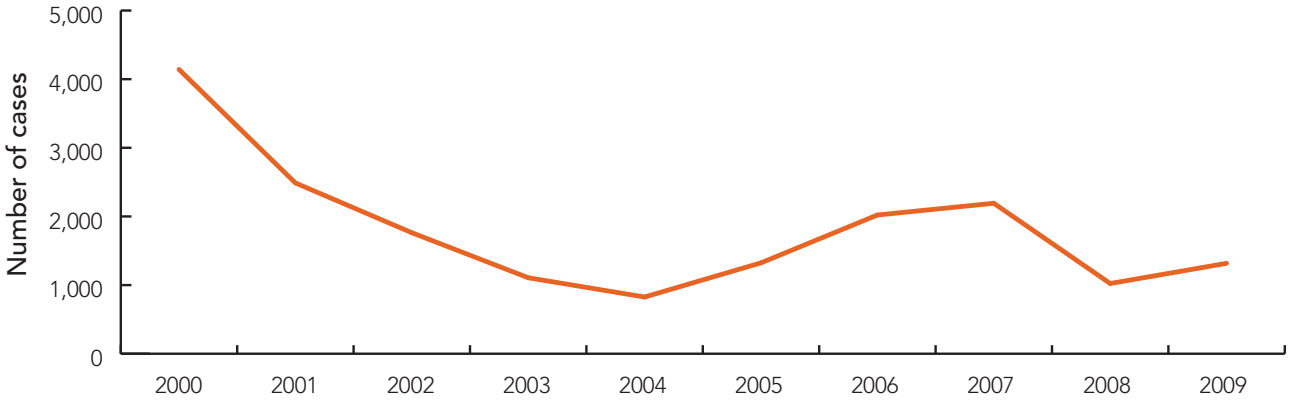
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases



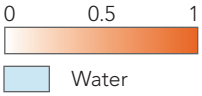
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles lesteri*

2. *Anopheles sinensis*

Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) lesteri Baisas & Hu, 1936	Important vector	Cool shady places, hills and grassy fields, fresh-water pools	Both	Data not available	Endophilic	Dusk/ night
Anopheles (Anopheles) sinensis species complex	Important vector of *P. vivax* malaria	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night

SOLOMON ISLANDS

Overview

Malaria at a Glance

Reported cases of malaria (59% *P. falciparum*)	33,002
Deaths from malaria	53
Population at risk (%) (Total population: 535,699)	97
Annual parasite index (cases/1,000 total population/year)	61
Slide positivity rate (%)	14

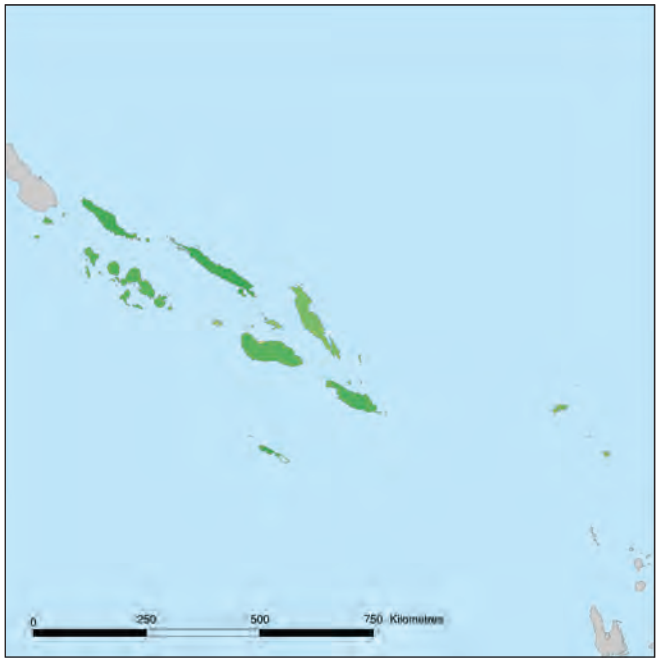
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,030
Country income level	Lower middle
Annual per capita health expenditure (US$)	72
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	6
Life expectancy (years)	67

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

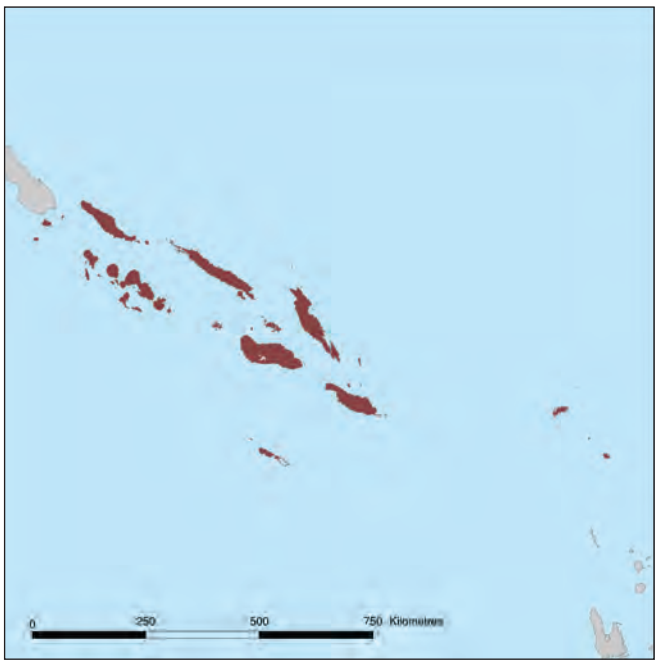
Water

Strategic Program Goals for Elimination

- Reduce the national annual parasite index by 64% between 2007 and 2014
- Reduce annual malaria-related deaths from 7/100,000 to less than 0.1/100,000 by 2014
- Eliminate malaria in Isabel and Temotu Provinces by 2014

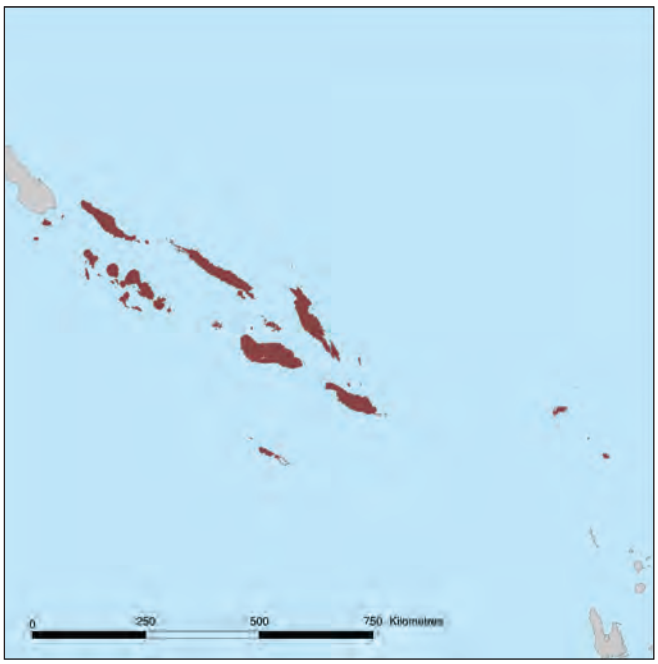
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

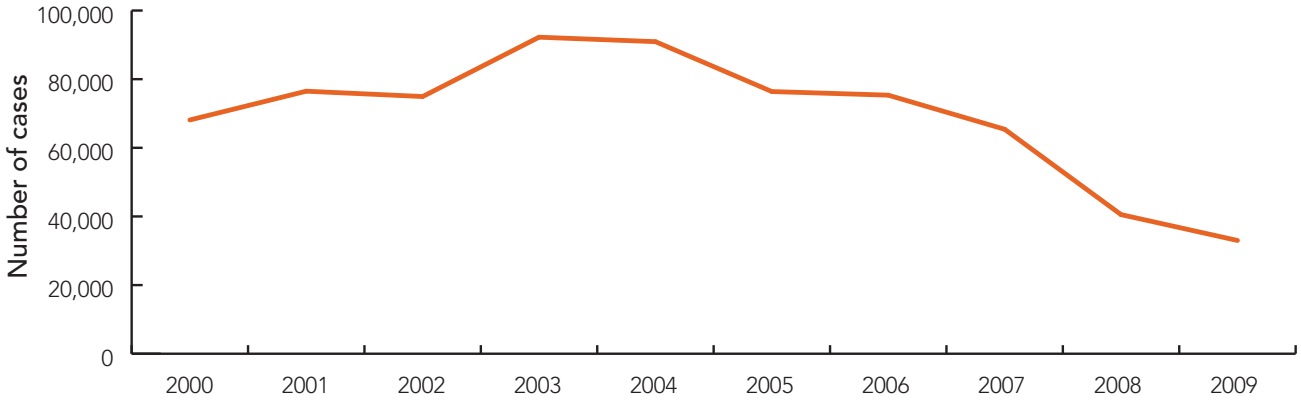
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases

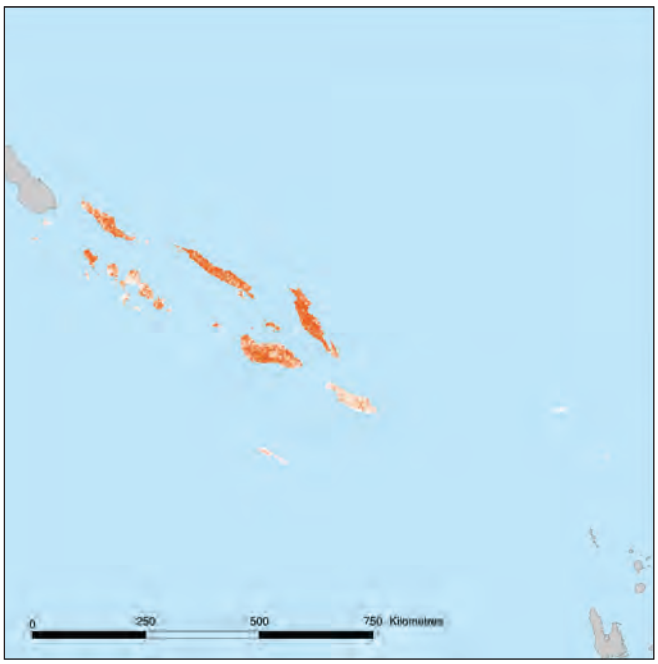


Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. Farauti Complex

2. *Anopheles koliensis*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) farauti species complex	Includes important vector species	Coastal areas, brackish or fresh water, highland river valleys, a great variety of aquatic habitats	Anthropophilic/ both	Both	Exophilic/both	Day/ dusk/ night
Anopheles (Cellia) koliensis Owen, 1945	Important vector throughout range	Irrigation ditches and ponds in sun-light with vegetation	Anthropophilic	Both	Exophilic/both	Night/ all

SRI LANKA

Overview

Malaria at a Glance

Reported cases of malaria (96% *P. vivax*)	531
Deaths from malaria	N/A
Population at risk (%) (Total population: 20.5 million)	23
Annual parasite index (cases/1,000 total population/year)	0.02
Slide positivity rate (%)	0.06

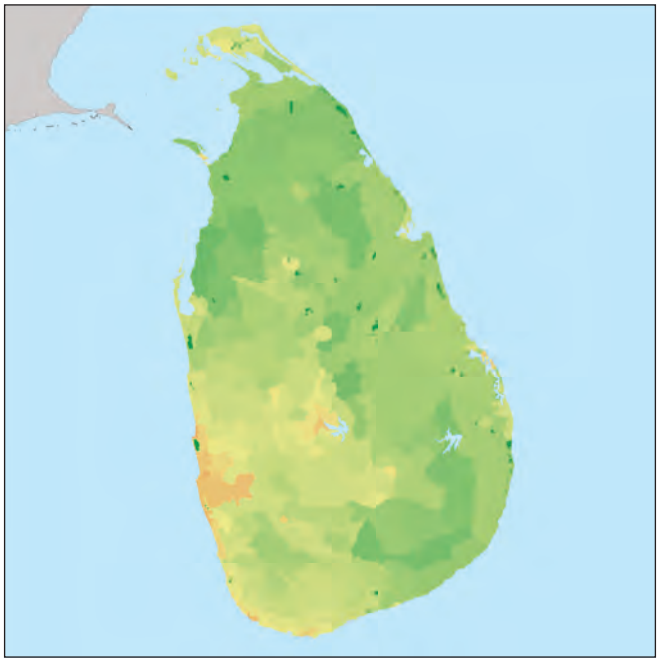
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	2,290
Country income level	Lower middle
Annual per capita health expenditure (US$)	84
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	55
Life expectancy (years)	74

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

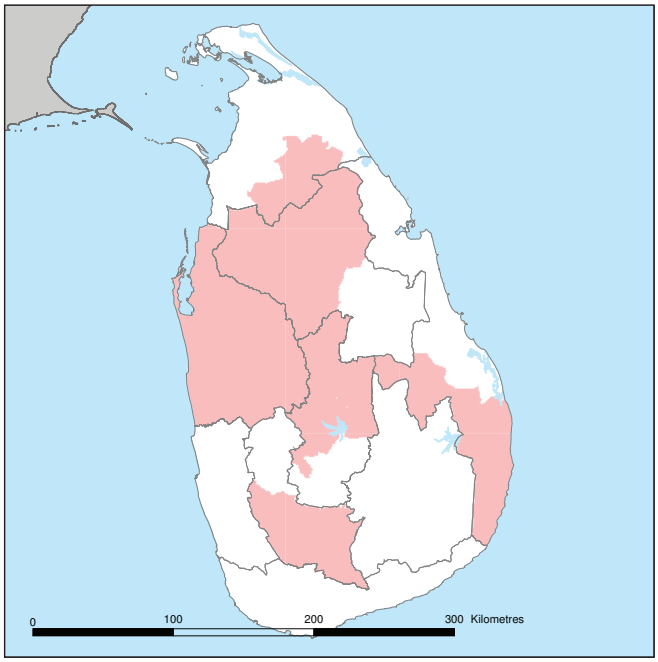
Water

Strategic Program Goals for Elimination

- Eliminate *P. falciparum* by the end of 2012
- National malaria elimination by the end of 2014

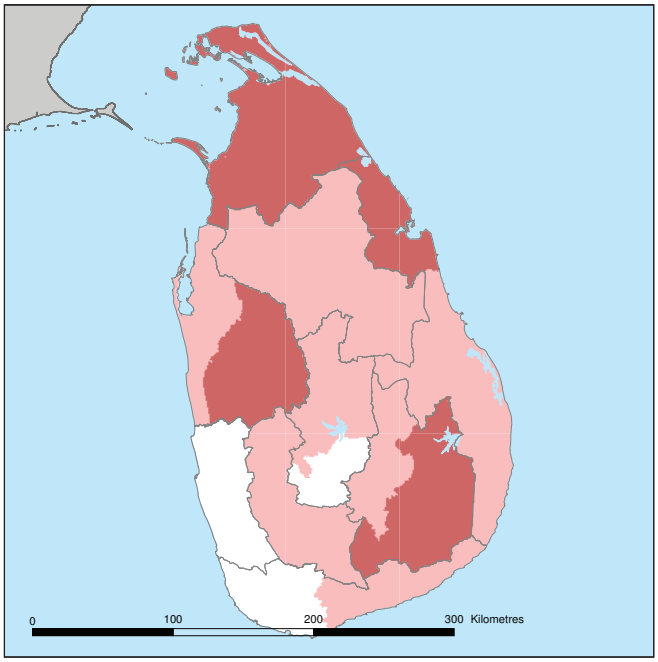
Malaria Transmission Limits

Plasmodium falciparum



- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

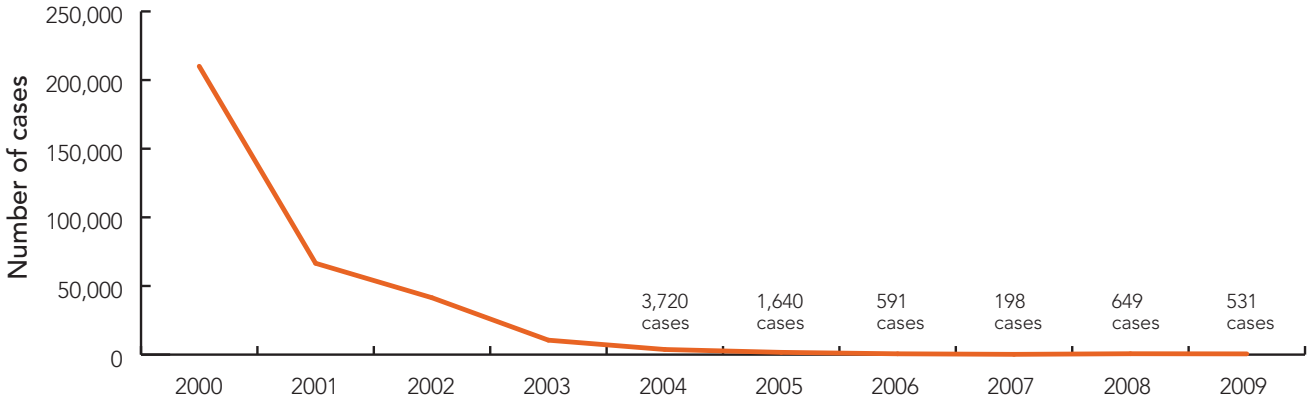
Plasmodium vivax



- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

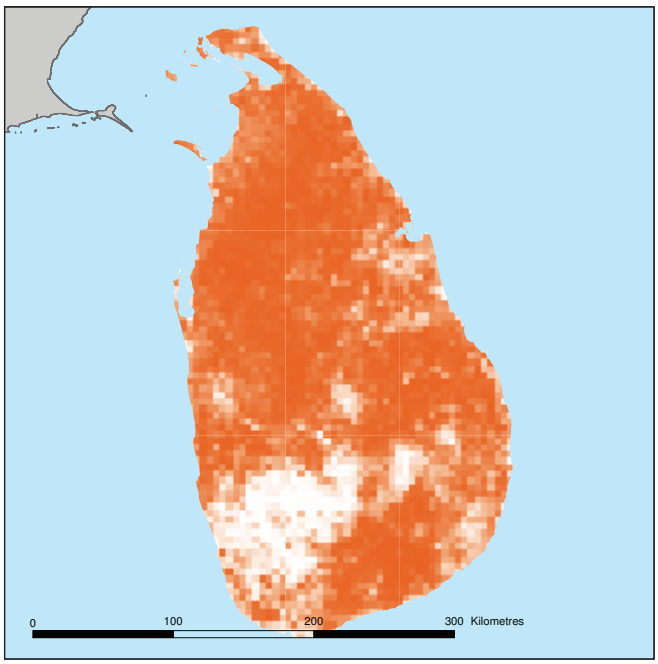
Reported Malaria Cases



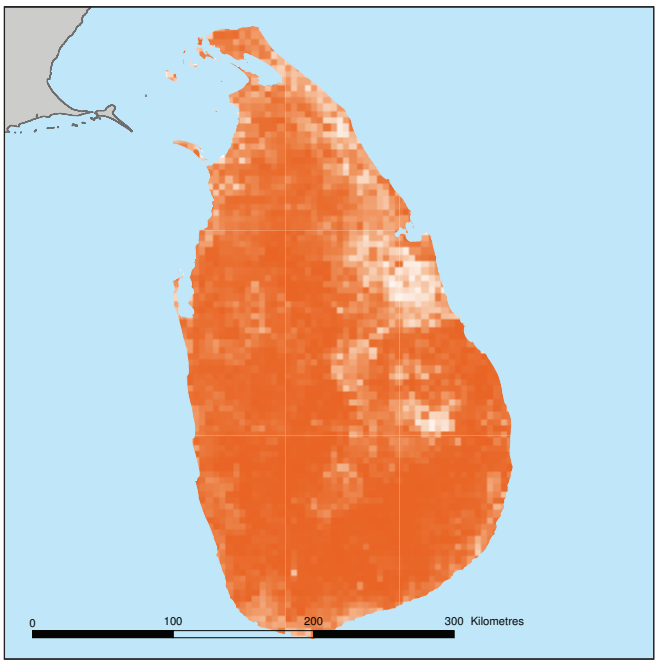
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

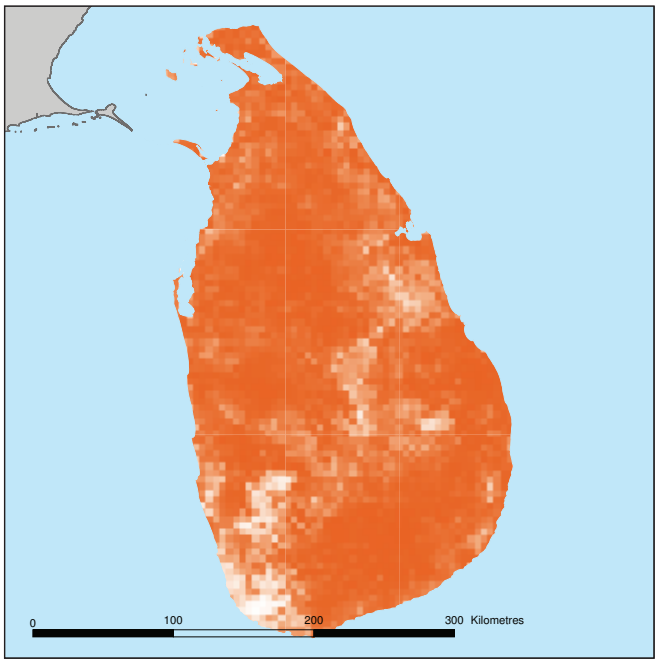
1. Culicifacies Complex



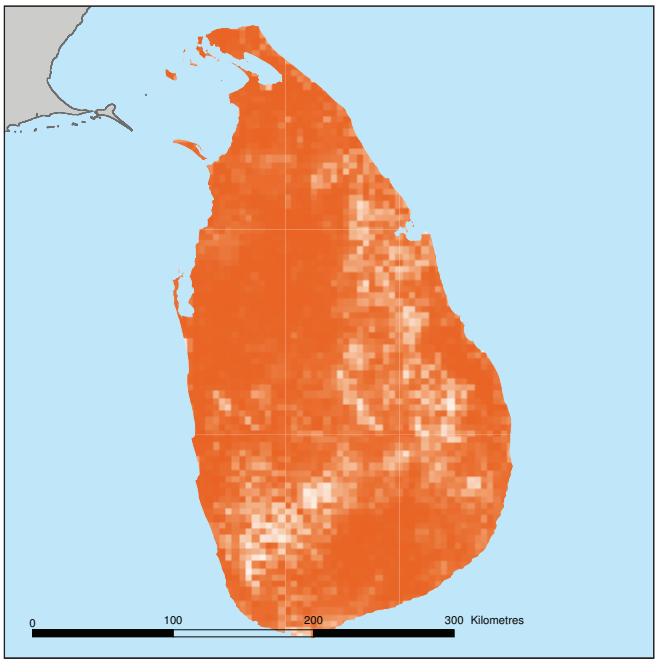
2. *Anopheles annularis*



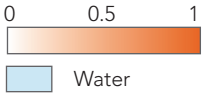
3. *Anopheles aconitus*



4. Subpictus Complex



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) culicifacies species complex	Variable depending on species and location	Forested areas with perennial streams, deforested riverine ecosystems and irrigated areas	Zoophilic/both	Both	Endophilic	Dusk/ night
Anopheles (Cellia) annularis van der Wulp, 1884	Important vector	Irrigated areas/rice fields/hilly-forested areas	Zoophilic	Both	Endophilic	Night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	From coastal plains to upland rice fields	Zoophilic	Both	Exophilic/ both	Dusk/ night
Anopheles (Cellia) subpictus species complex	Variable depending on species and location	Coastal brackish water, riverine pools and rice fields	Zoophilic	Both	Endophilic	Dusk/ night
Anopheles (Anopheles) barbirostris species complex; *Anopheles (Cellia) maculatus* Group	Present but non or minor vector in Sri Lanka					

THAILAND

Overview

Malaria at a Glance

Reported cases of malaria (43% *P. vivax*)	31,771
Deaths from malaria	70
Population at risk (%) (Total population: 68.1 million)	50
Annual parasite index (cases/1,000 total population/year)	0.4
Slide positivity rate (%)	1.7

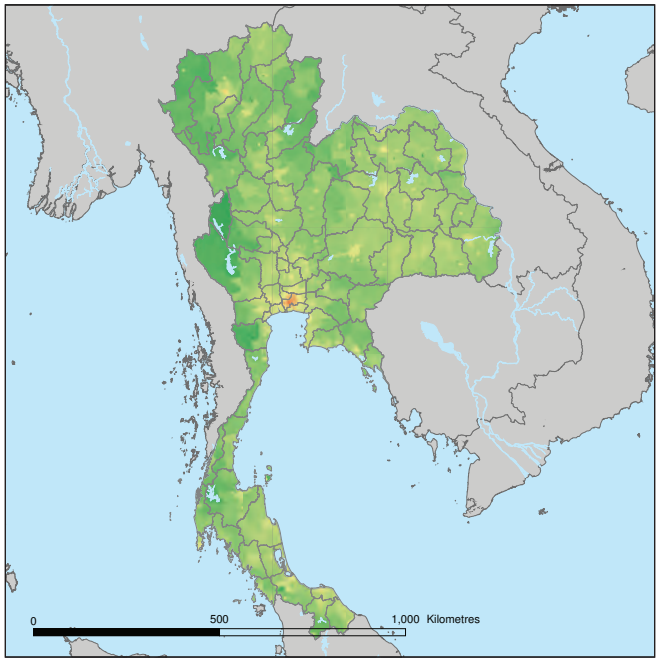
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	4,210
Country income level	Upper middle
Annual per capita health expenditure (US$)	168
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	24
Life expectancy (years)	69

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

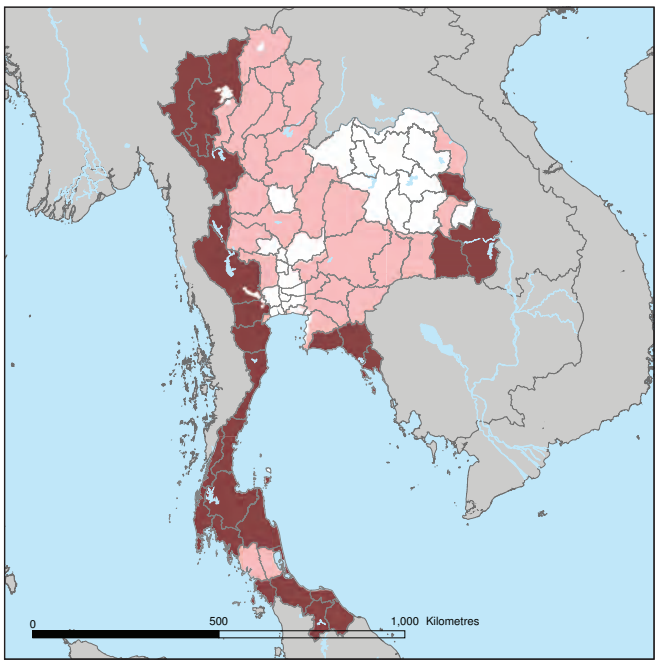
Water

Strategic Program Goals for Elimination

- Eighty percent of Thailand will be malaria free by 2020
- To reduce malaria in the population at-risk by 50% between 2008 and 2012
- To reduce morbidity and mortality rates by 50% between 2008 and 2012

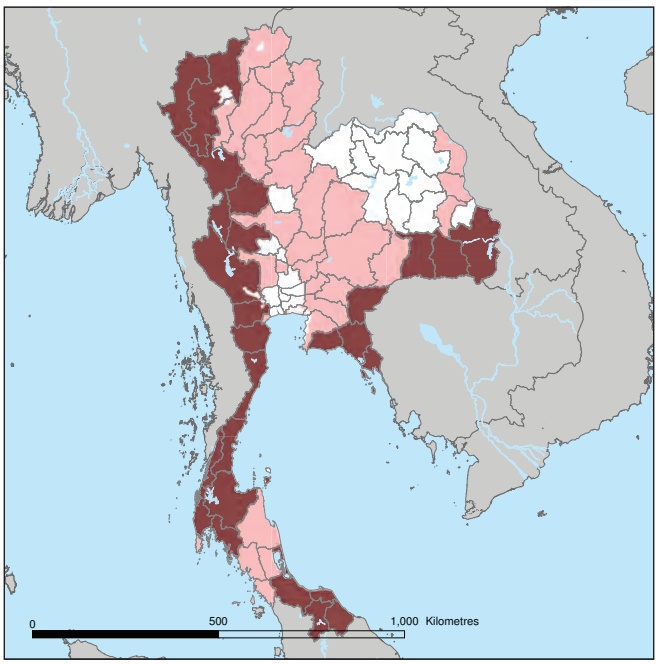
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

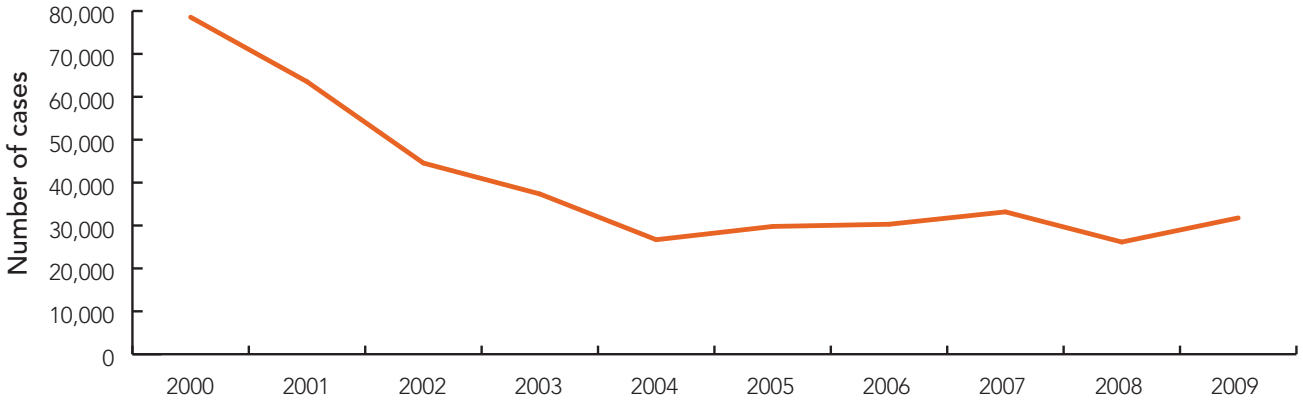
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

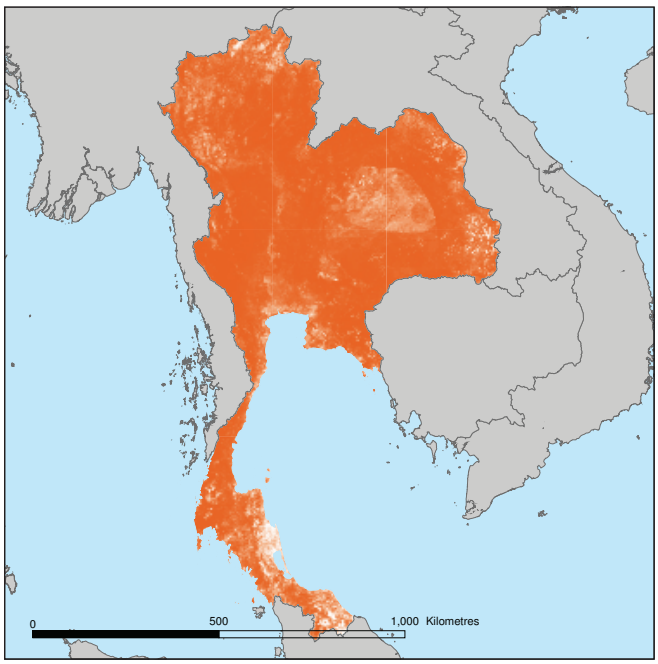
Reported Malaria Cases



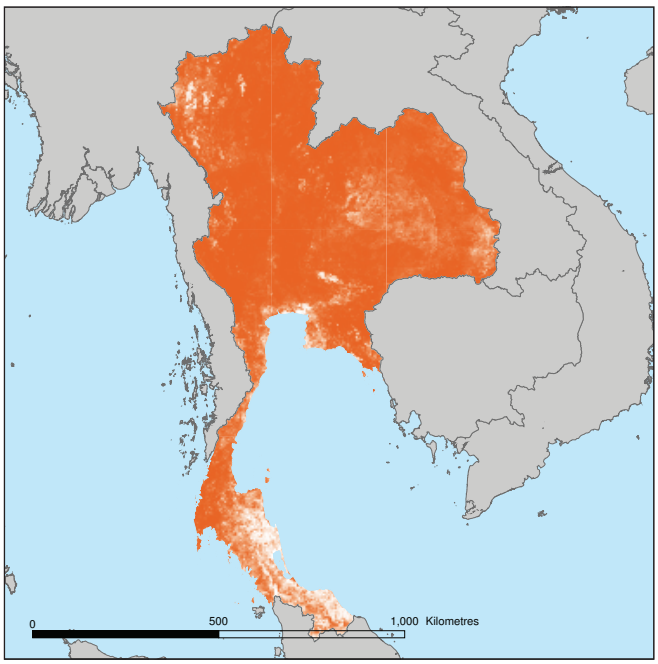
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

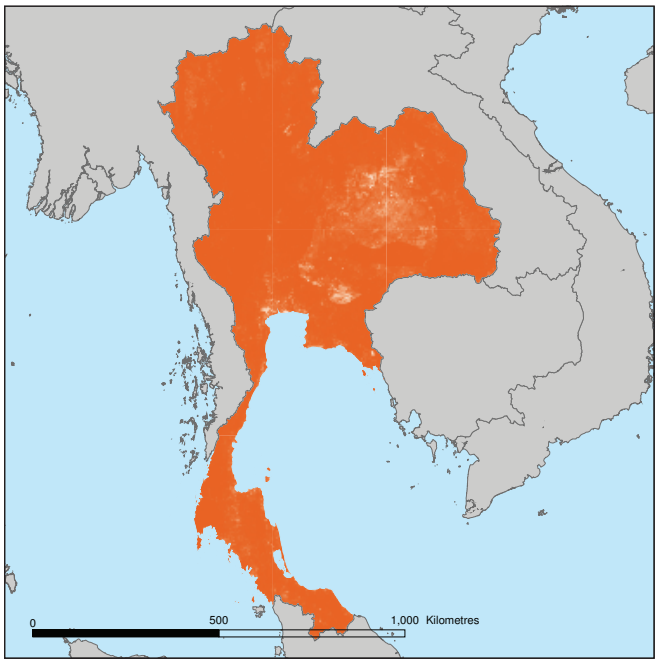
1. Dirus Complex



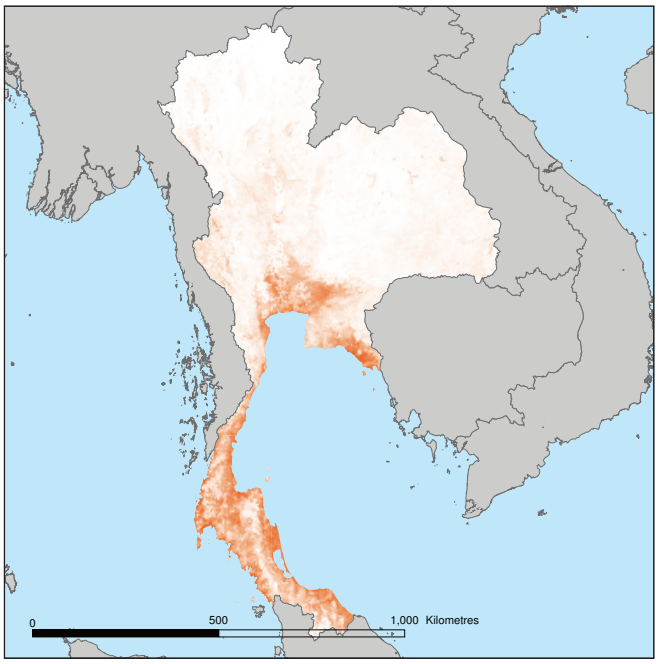
2. Minimus Complex



3. Maculatus Group



4. Sundaicus Complex



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) dirus species complex	Includes highly competent vector species	Forested mountains and foothills, cultivated forests, plantations and forest fringes	Anthropophilic	Both	Exophilic	Night
Anopheles (Cellia) minimus species complex	Important malaria vectors	Forested hills, agricultural fields including traditional rice agro-ecosystems, 200–900m	Both	Both	Both	Dusk/ night
Anopheles (Cellia) maculatus Group	Variable depending on species and location	Hilly and mountainous areas, permanent or semi-permanent clean water bodies of sunlit water	Zoophilic/both	Both	Exophilic	Dusk/ night
Anopheles (Cellia) sundaicus species complex	Variable depending on location	Open mangrove and coastal shrimp or fish ponds, inland seawater canals	Anthropophilic/ both	Both	Both	Night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	Coastal plain and upland rice fields	Zoophilic	Both	Exophilic/ both	Dusk/ night
Anopheles (Anopheles) sinensis species complex	Secondary vector in Thailand	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Cellia) subpictus species complex	Variable depending on species and location	Coastal brackish water, riverine pools and rice fields	Zoophilic	Both	Endophilic	Dusk/ night
Anopheles (Cellia) annularis van der Wulp, 1884; *Anopheles (Anopheles) barbirostris* species complex; *Anopheles (Cellia) culicifacies* species complex; *Anopheles (Cellia) leucosphyrus* and *Anopheles (Celia) latens*	Present but non or minor vector in Thailand					

VANUATU

Overview

Malaria at a Glance

Reported cases of malaria (41% *P. vivax*)	3,915
Deaths from malaria	2
Population at risk (%) (Total population: 239,651)	99
Annual parasite index (cases/1,000 total population/year)	16
Slide positivity rate (%)	16

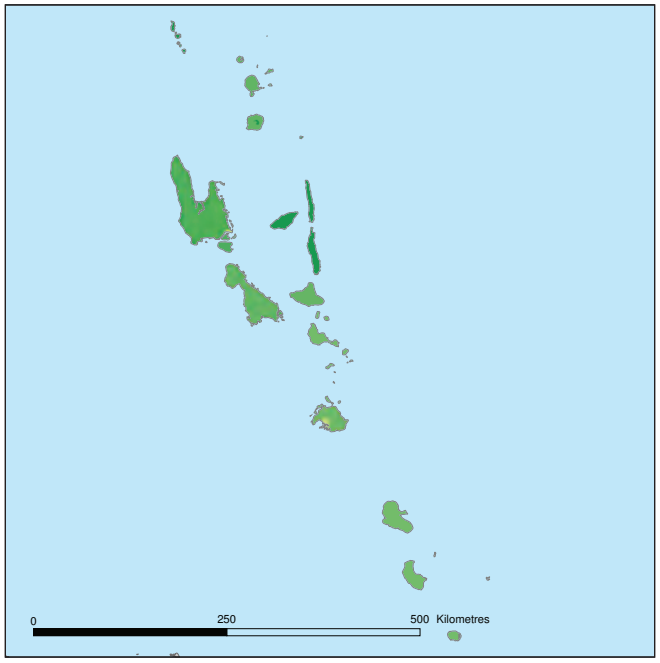
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	2,760
Country income level	Lower middle
Annual per capita health expenditure (US$)	106
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	18
Life expectancy (years)	71

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

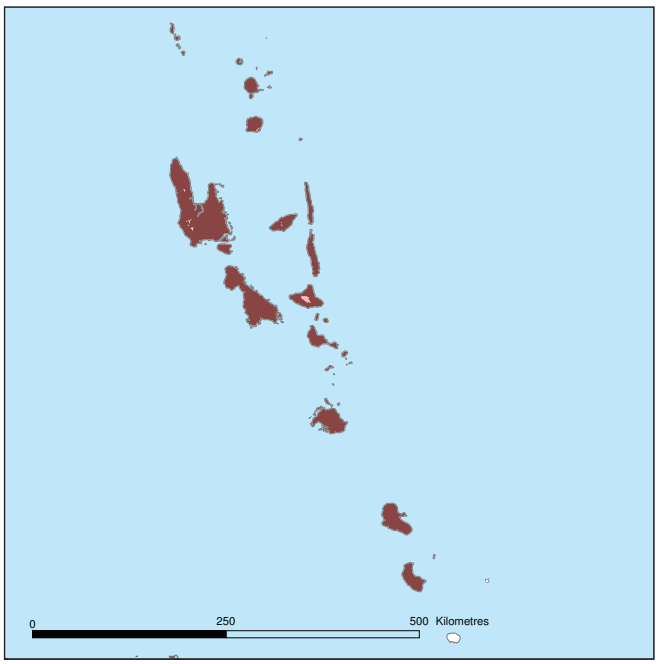
Water

Strategic Program Goals for Elimination

- Reduce the annual parasite index between 2007 and 2016 by 70%
- Reduce malaria-related deaths between 2007 and 2016 to zero
- Eliminate malaria from Tafea Province by 2012

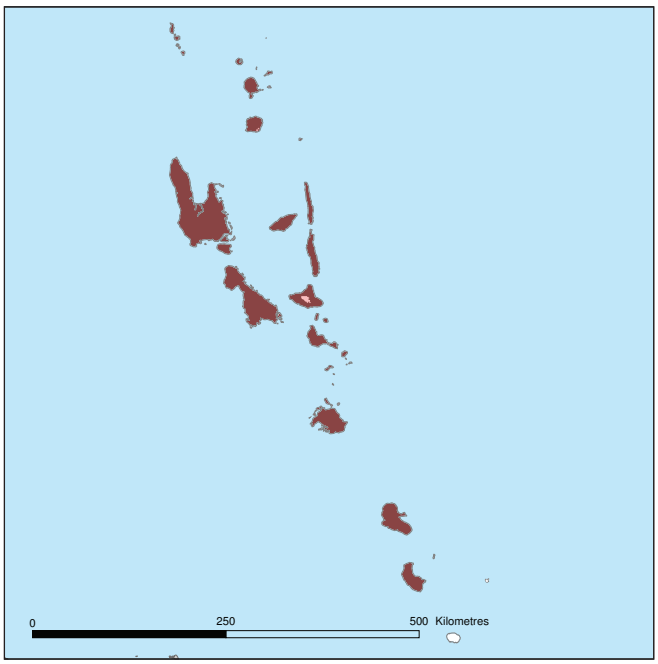
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

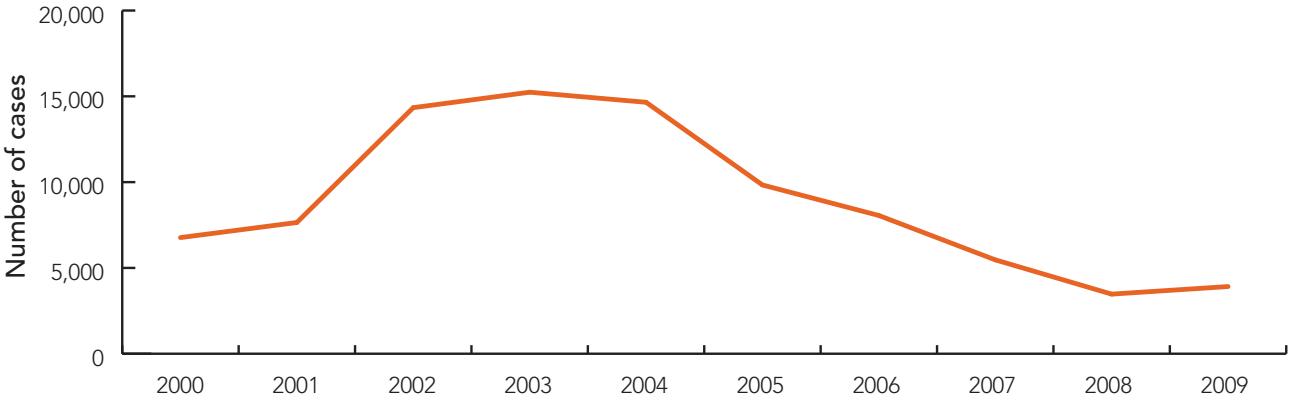
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

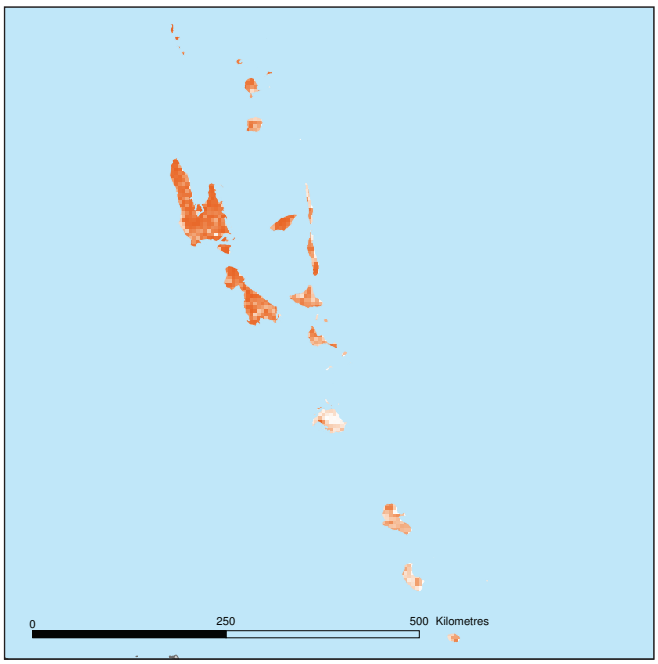
Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. Farauti Complex



Probability of occurrence scale

0 0.5 1

Water

This map shows the predicted probability of occurrence of this vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) farauti species complex	Variable depending on species and location	Coastal areas, brackish or fresh water, highland river valleys, a great variety of aquatic habitats	Anthropophilic/ both	Both	Exophilic/both	Day/ dusk/ night

VIETNAM

Overview

Malaria at a Glance

Reported cases of malaria (79% *P. falciparum*)	16,130
Deaths from malaria	26
Population at risk (%) (Total population: 88.4 million)	90
Annual parasite index (cases/1,000 total population/year)	0.2
Slide positivity rate (%)	0.5

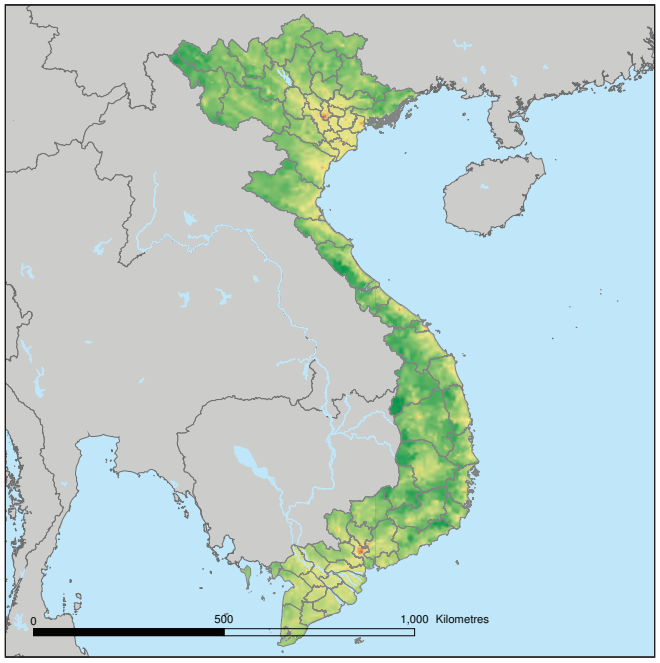
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,100
Country income level	Lower middle
Annual per capita health expenditure (US$)	80
Total health expenditure as % of GDP	7
Private health expenditure as % of total health expenditure	61
Life expectancy (years)	75

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

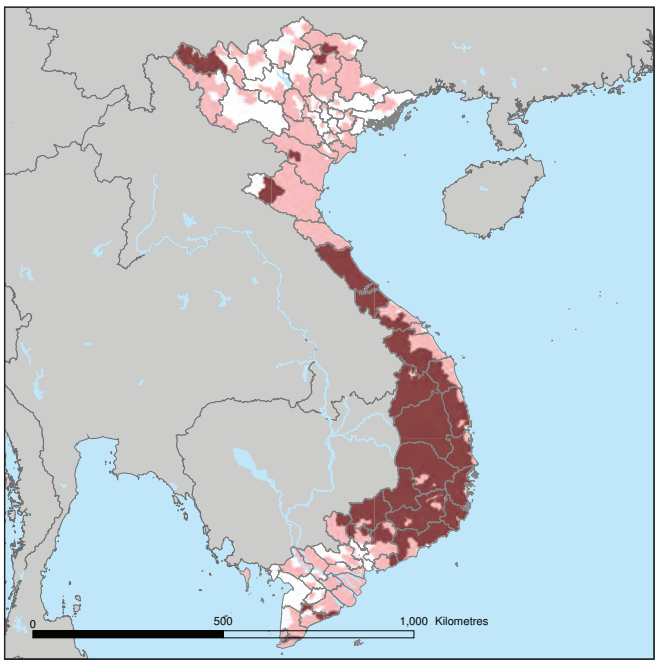
Water

Strategic Program Goals for Elimination

- Achieve a 50% reduction of malaria incidence in target districts between 2007 and 2012
- Reduce malaria morbidity below 0.15 per 1,000 population by 2020
- Reduce malaria mortality below 0.02 per 100,000 population by 2020
- National malaria elimination by 2030

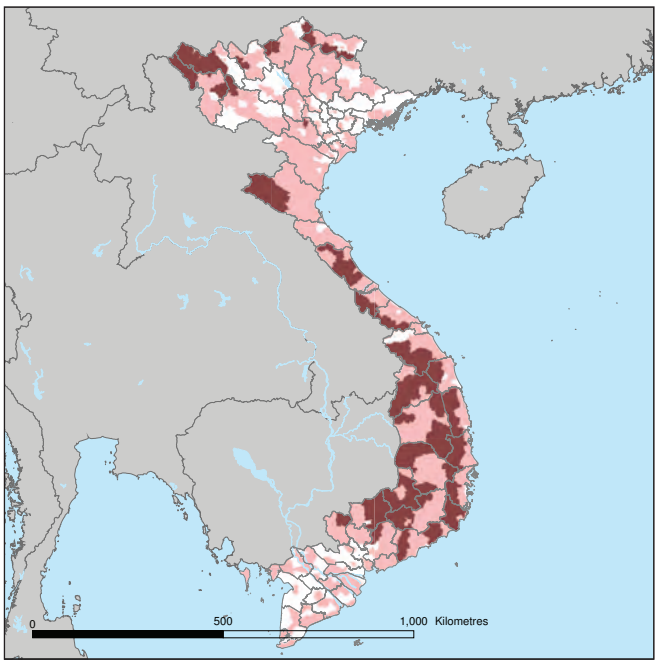
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

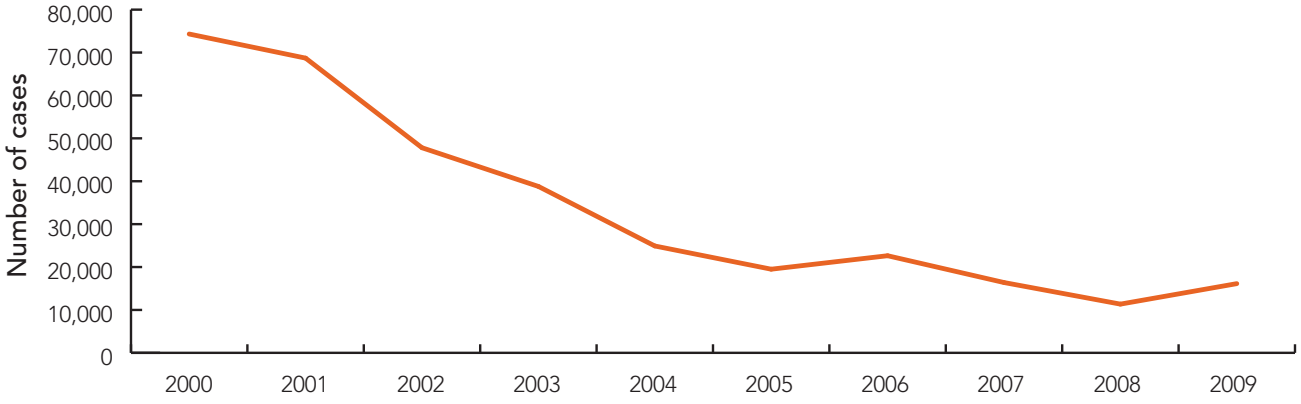
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

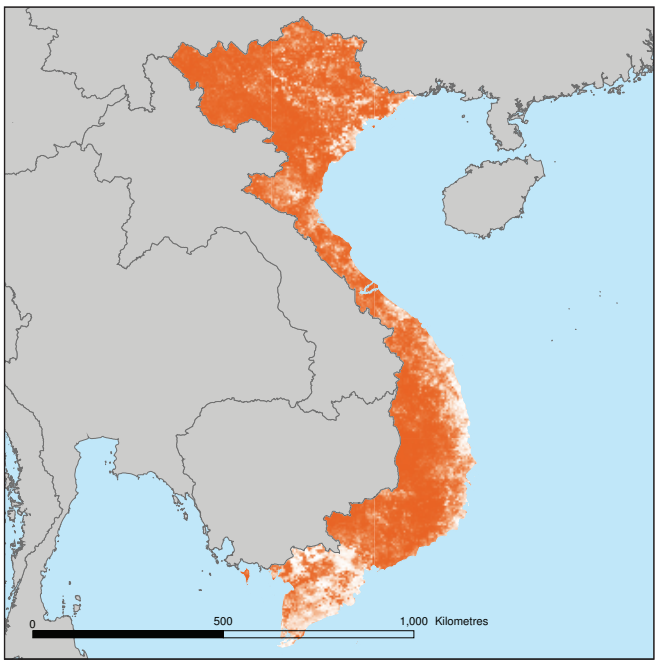
Reported Malaria Cases



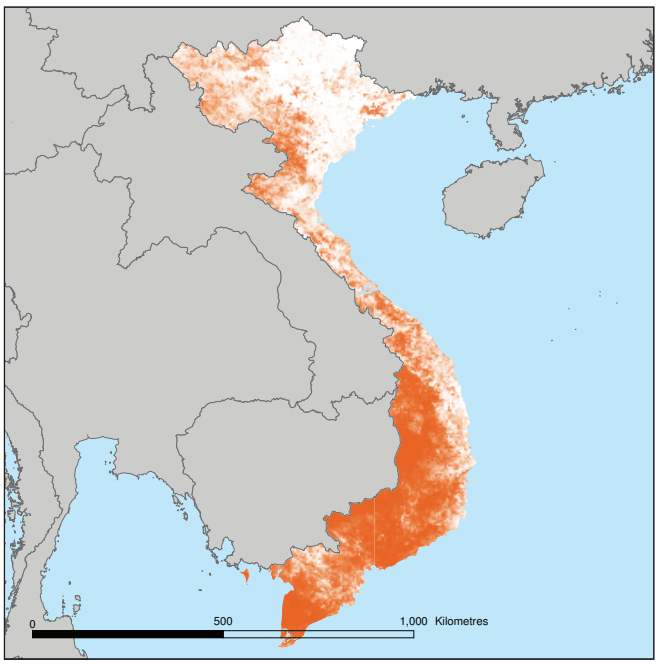
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

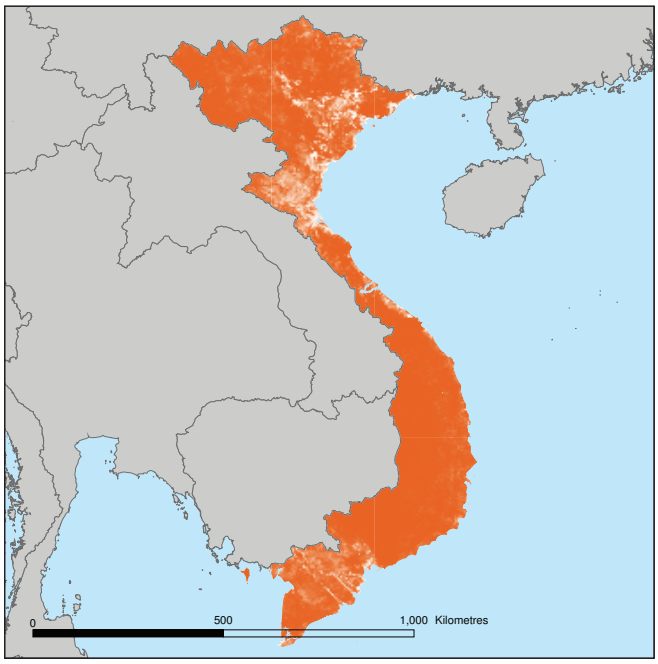
1. Minimus Complex



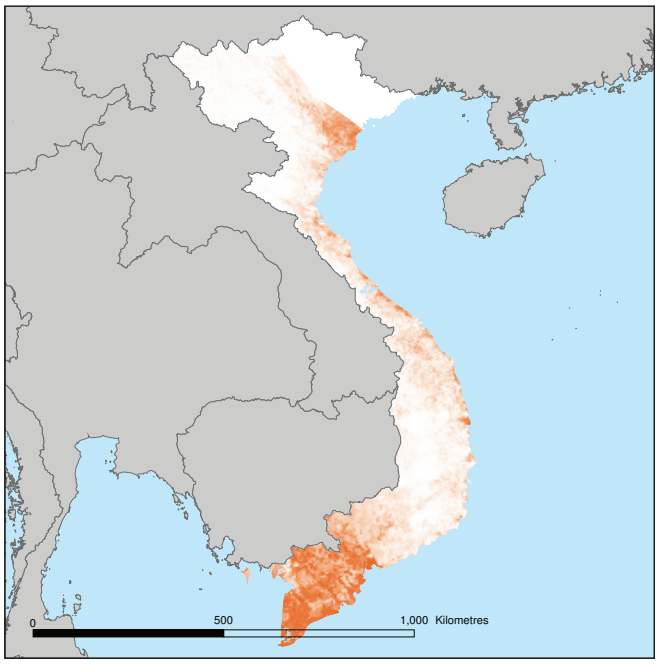
2. Dirus Complex



3. Maculatus Group



4. Sundaicus Complex



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

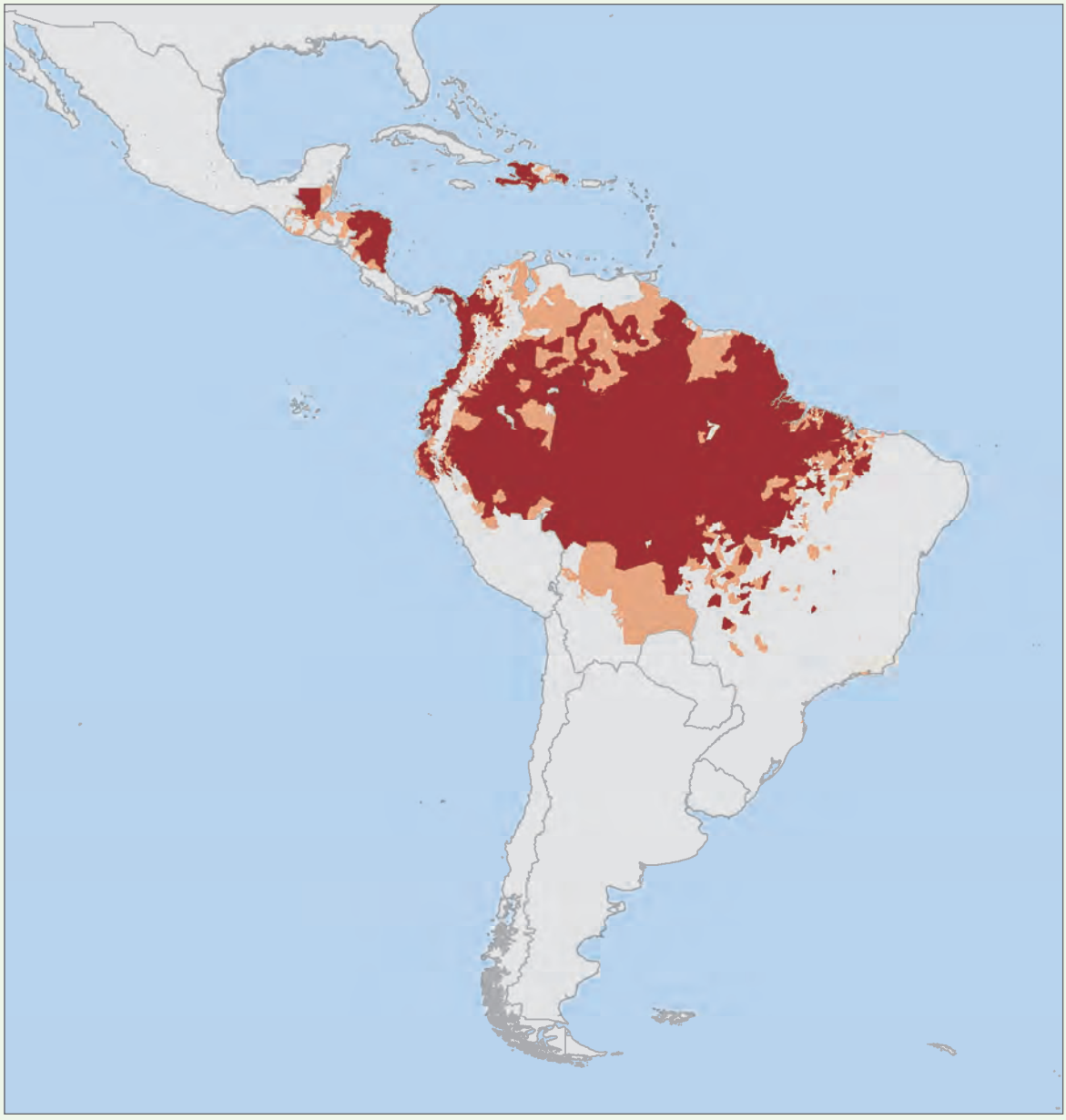
Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) minimus species complex	Important malaria vectors	Forested hills, agricultural fields including traditional rice agro-ecosystems, 200–900m	Both	Both	Both	Dusk/ night
Anopheles (Cellia) dirus species complex	Includes highly competent vector species	Forested mountains and foothills, cultivated forests, plantations and forest fringes	Anthropophilic	Both	Exophilic	Night
Anopheles (Cellia) maculatus Group	Variable depending on species and location	Hilly and mountainous areas, permanent or semi-permanent clean water bodies of sunlit water	Zoophilic/both	Both	Exophilic	Dusk/ night
Anopheles (Cellia) sundaicus species complex	Variable depending on location	Open mangrove and coastal shrimp or fish ponds, inland seawater canals	Anthropophilic/ both	Both	Both	Night
Anopheles (Cellia) aconitus Dönitz, 1902	Variable depending on location and abundance	Coastal plain and upland rice fields	Zoophilic	Both	Exophilic/ both	Dusk/ night
Anopheles (Anopheles) sinensis species complex	Variable depending on location and abundance	Lowland freshwater habitats with vegetation in open areas	Zoophilic	Exophagic	Exophilic	Dusk/ night
Anopheles (Cellia) subpictus species complex	Variable depending on species and location	Coastal brackish water, riverine pools and rice fields	Zoophilic	Both	Endophilic	Dusk/ night
Anopheles (Cellia) annularis van der Wulp, 1884; *Anopheles (Anopheles) barbirostris* species complex; *Anopheles (Cellia) culicifacies* species complex	Present but non or minor vector in Vietnam					

Latin America and Caribbean

Argentina | Belize | Costa Rica | Dominican Republic
El Salvador | Mexico | Nicaragua | Panama | Paraguay

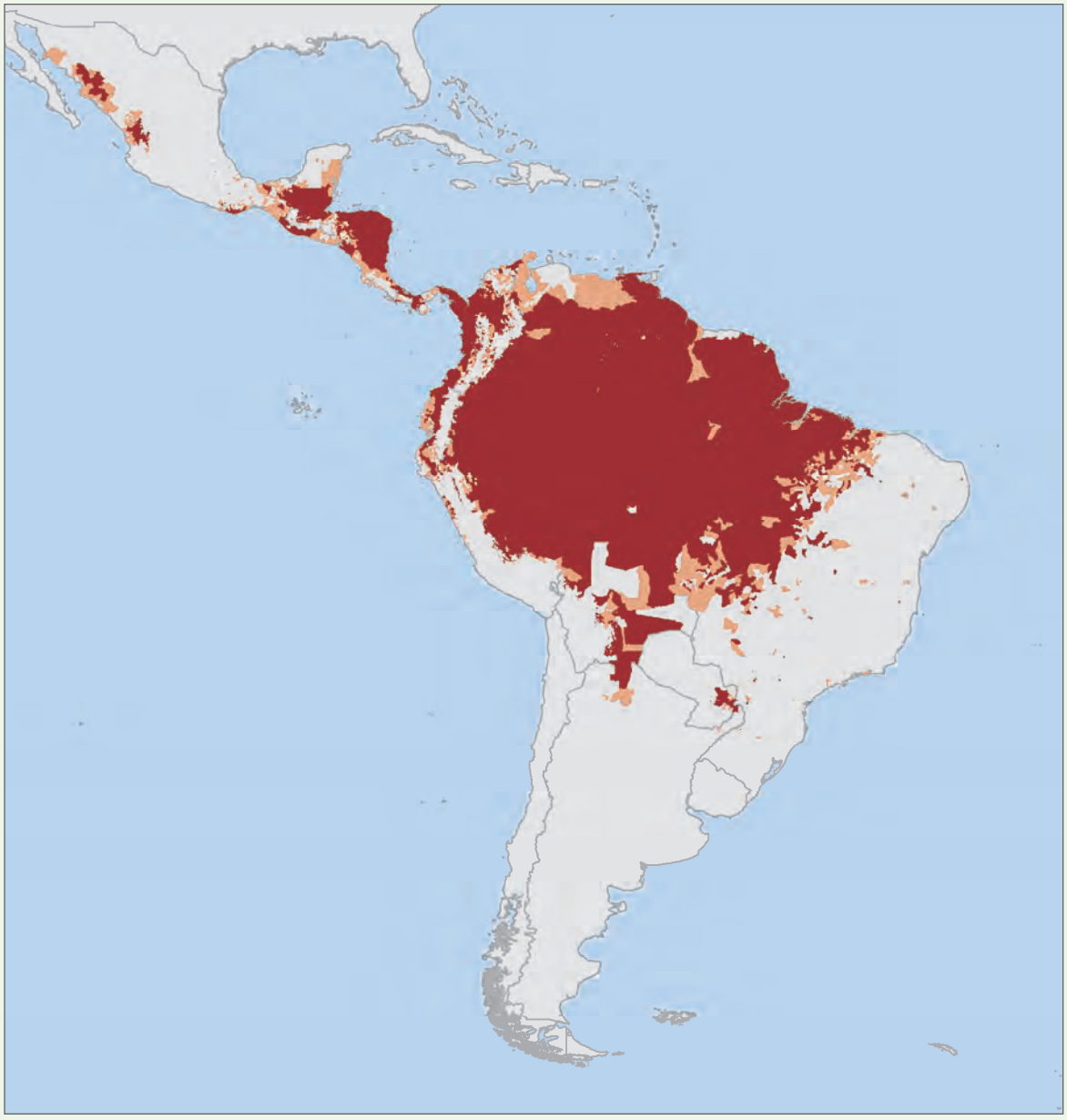
Malaria Transmission Limits for *Plasmodium falciparum*



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

Malaria Transmission Limits for *Plasmodium vivax*



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

ARGENTINA

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	154
Deaths from malaria	0
Population at risk (%) (Total population: 40.7 million)	9
Annual parasite index (cases/1,000 total population/year)	0.003
Slide positivity rate (%)	N/A

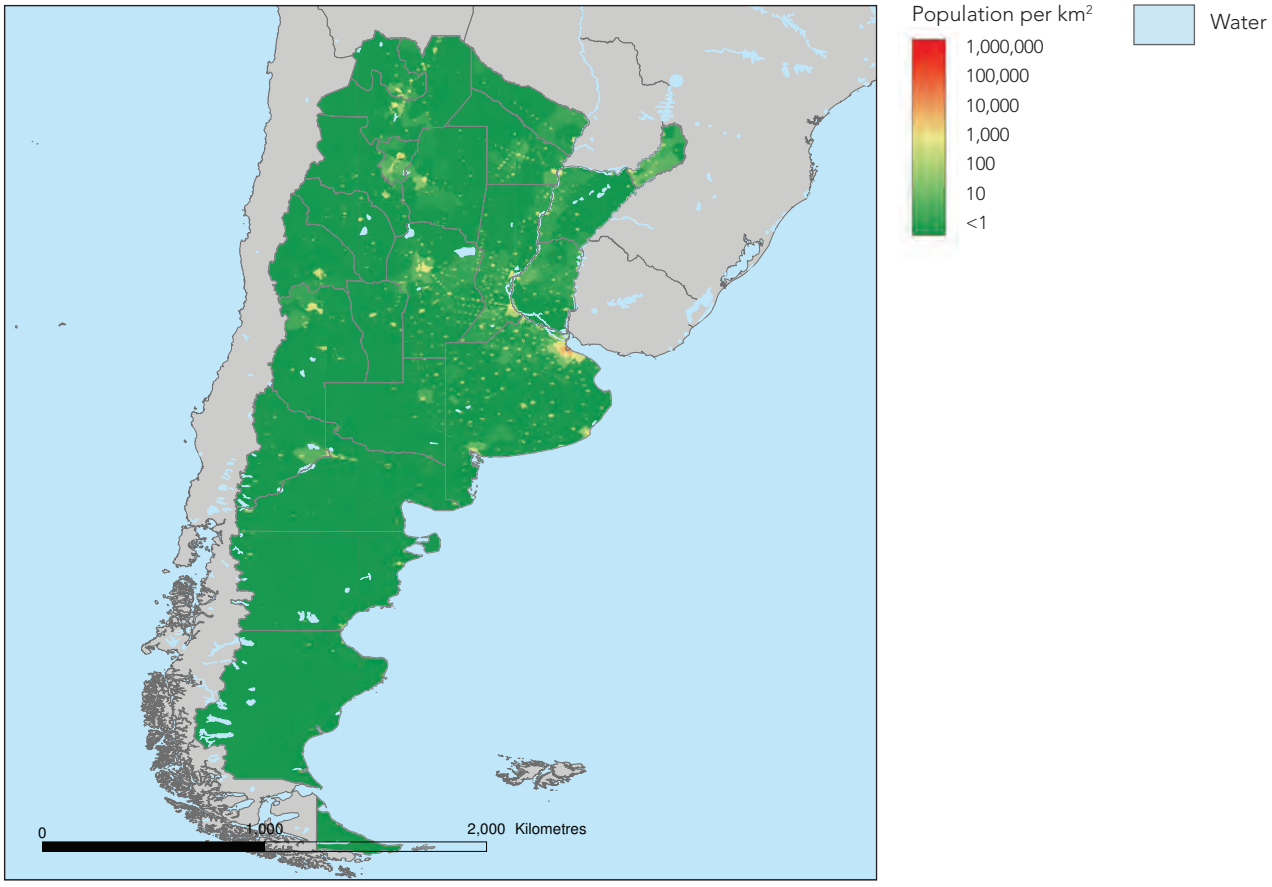
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	8,450
Country income level	Upper middle
Annual per capita health expenditure (US$)	730
Total health expenditure as % of GDP	9
Private health expenditure as % of total health expenditure	34
Life expectancy (years)	76

Source: World Bank, World Development Indicators

Human Population Density



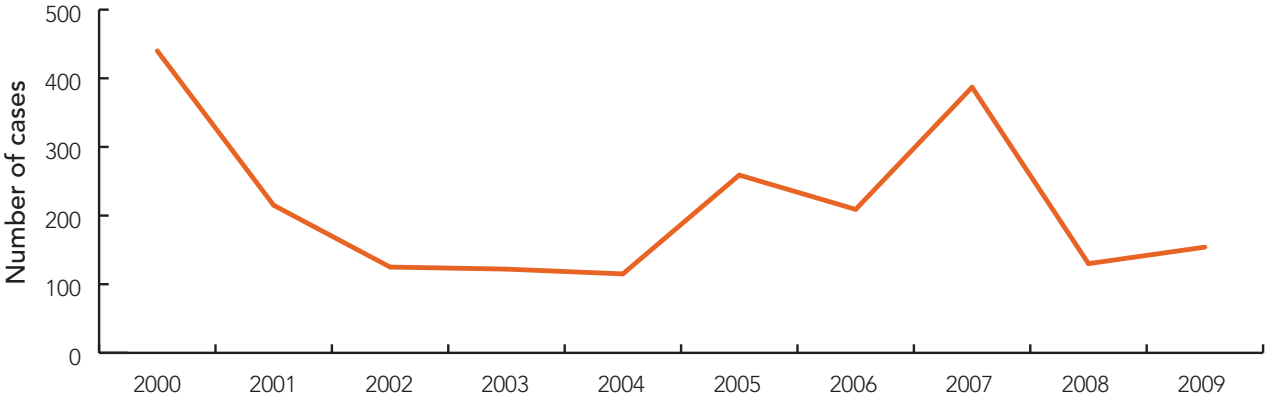
Malaria Transmission Limits

Plasmodium vivax

Water
P. vivax free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

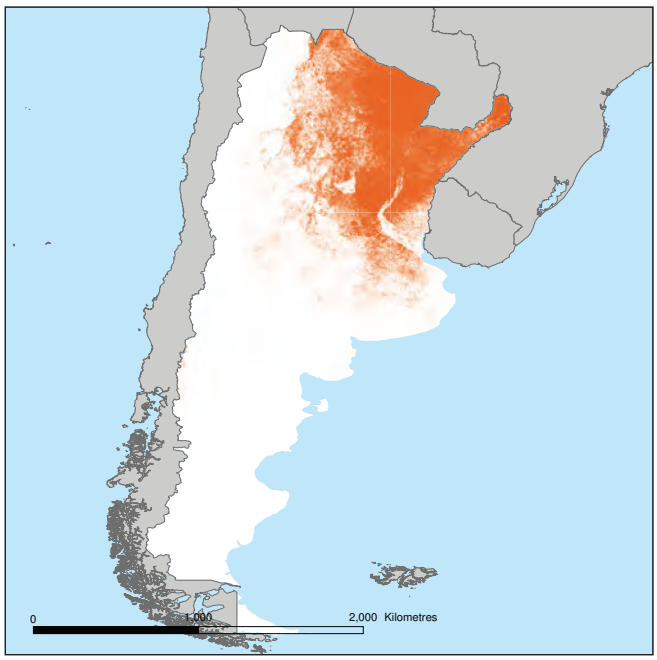
Reported Malaria Cases



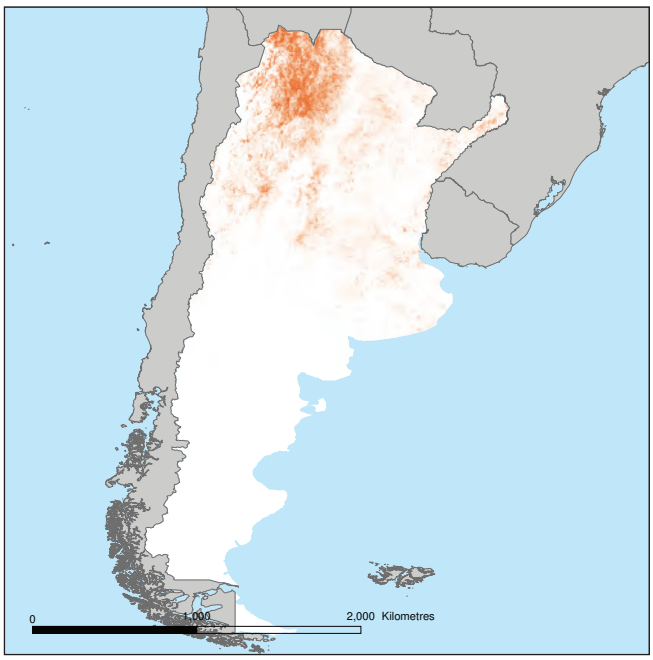
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. Albitarsis Complex



2. Pseudopunctipennis Complex



Probability of occurrence scale

0 0.5 1

Water

Anopheles marajoara is a member of the Albitarsis Complex, however it is not included in this map.

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albitarsis species complex	Variable depending on location	Sunlit lagoons, lakes, rice fields and brick pits	Both	Both	Exophilic/ both	Dusk/ night
Anopheles (Anopheles) pseudopunctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) darlingi Root, 1926	Present but non or minor vector in Argentina					

BELIZE

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	256
Deaths from malaria	0
Population at risk (%) (Total population: 344,700)	61
Annual parasite index (cases/1,000 total population/year)	0.7
Slide positivity rate (%)	1

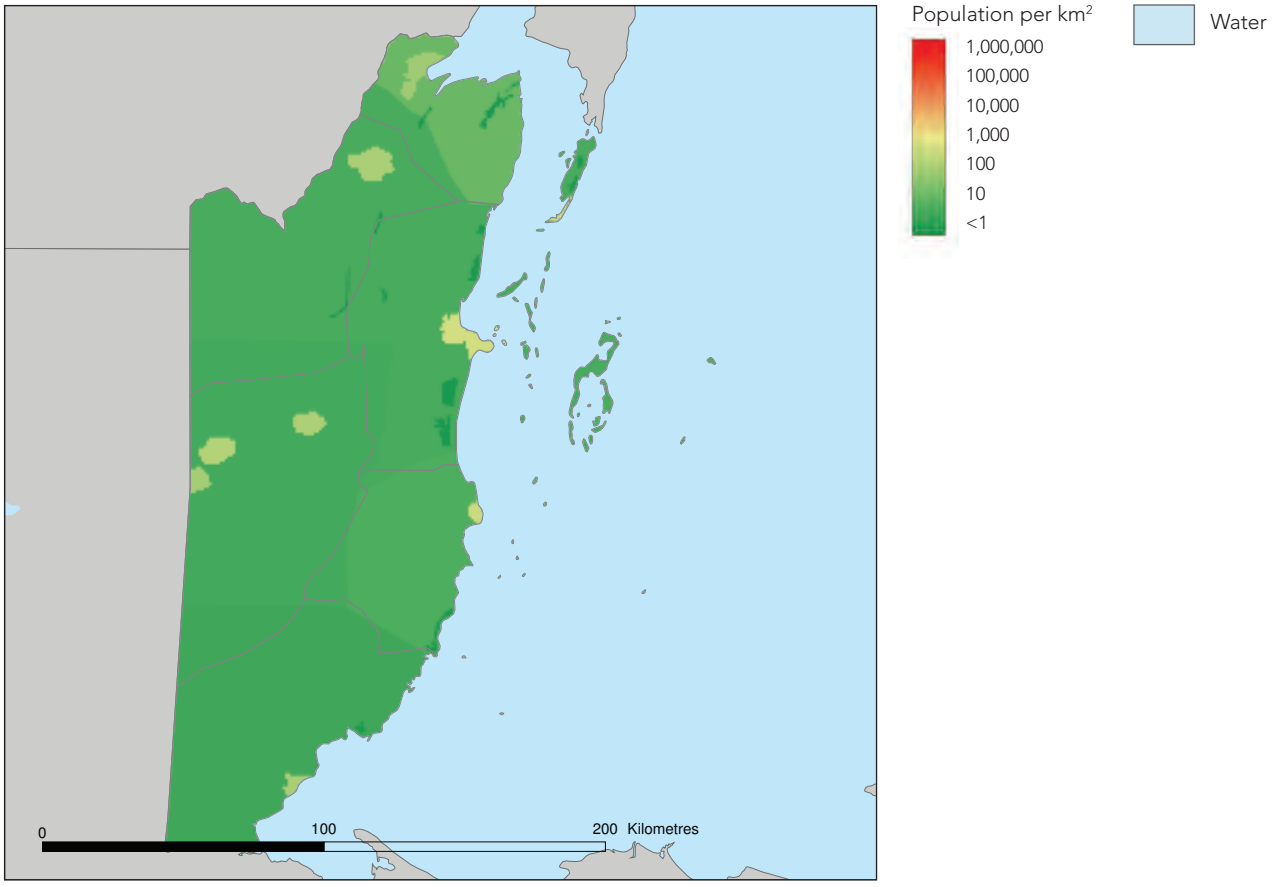
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	3,740
Country income level	Lower middle
Annual per capita health expenditure (US$)	217
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	27
Life expectancy (years)	77

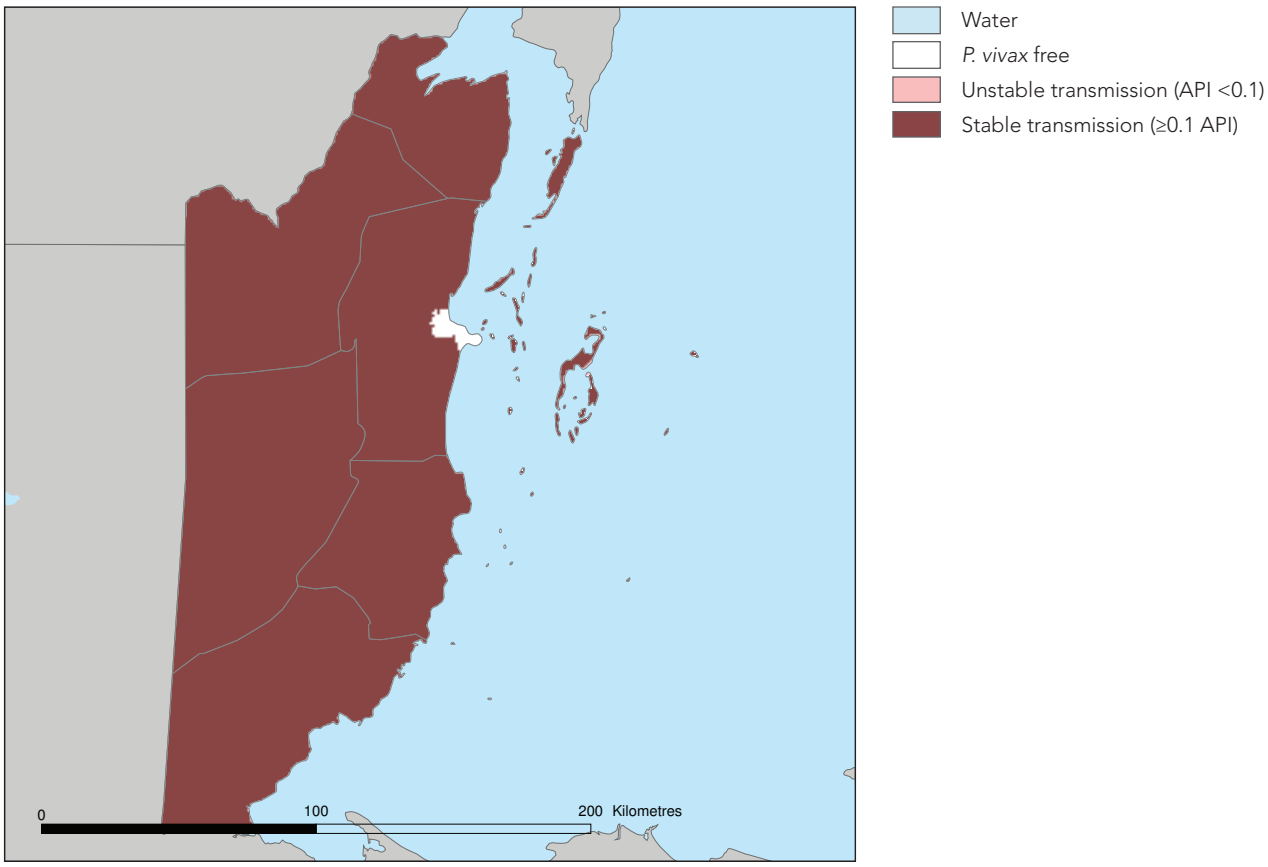
Source: World Bank, World Development Indicators

Human Population Density



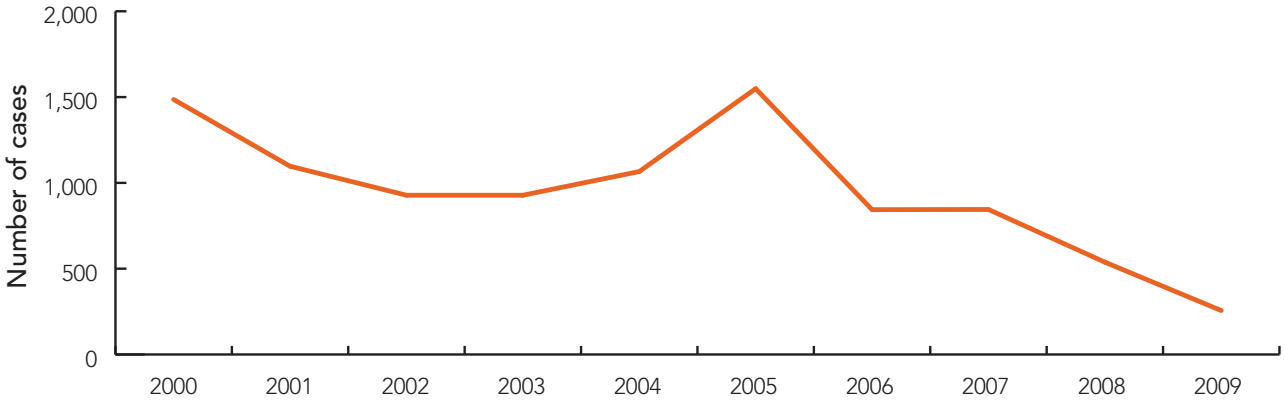
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

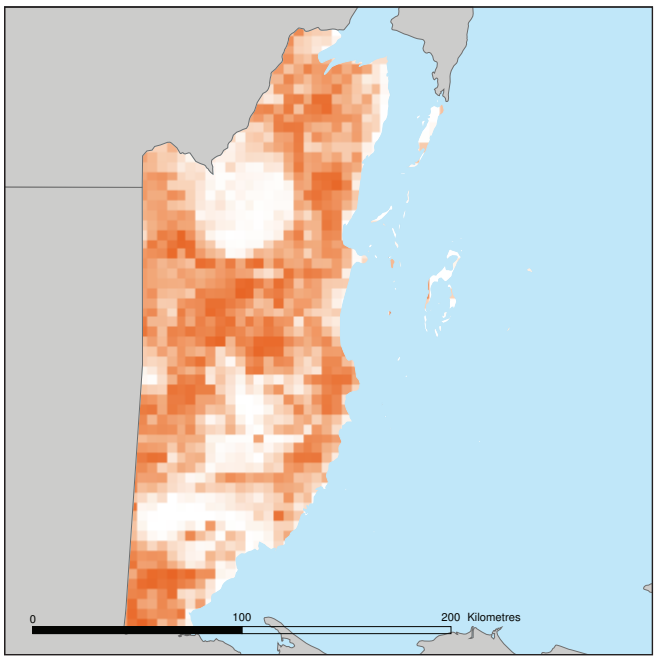
Reported Malaria Cases



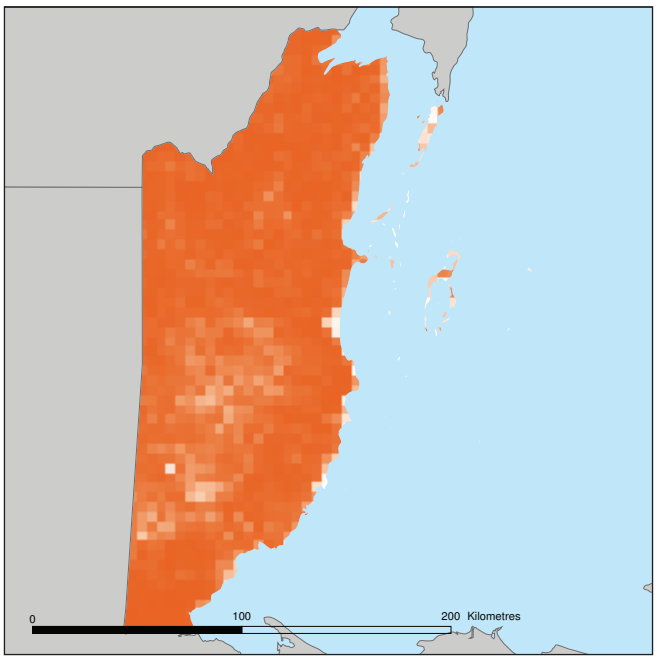
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

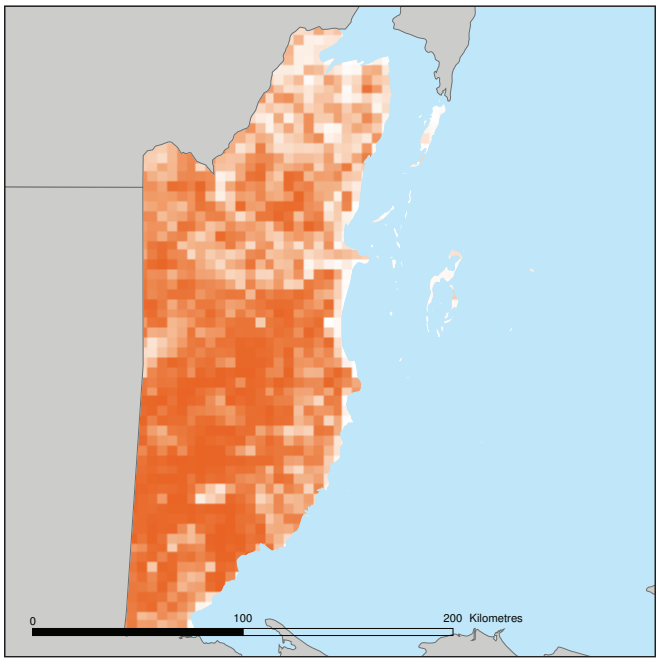
1. *Anopheles darlingi*



2. *Anopheles albimanus*



3. Pseudopunctipennis Complex



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) darlingi Root, 1926	Important vector throughout its range	Rural lowland forest	Anthropophilic	Both	Exophilic	Dusk/ night/ dawn
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudo-punctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night

COSTA RICA

Overview

Malaria at a Glance

Reported cases of malaria (99% *P. vivax*)	262
Deaths from malaria	1
Population at risk (%) (Total population: 4.6 million)	36
Annual parasite index (cases/1,000 total population/year)	0.05
Slide positivity rate (%)	5.4

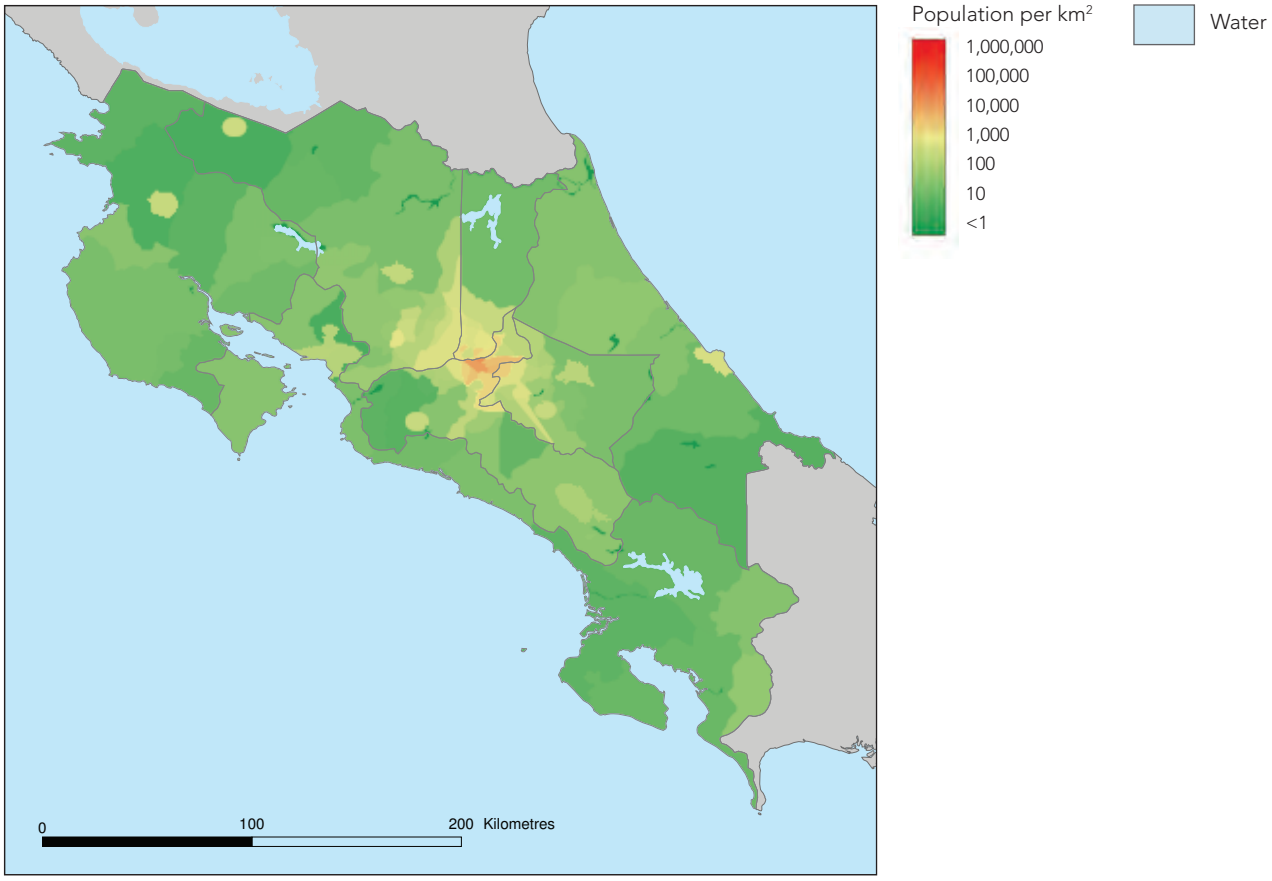
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	6,580
Country income level	Upper middle
Annual per capita health expenditure (US$)	668
Total health expenditure as % of GDP	10
Private health expenditure as % of total health expenditure	33
Life expectancy (years)	79

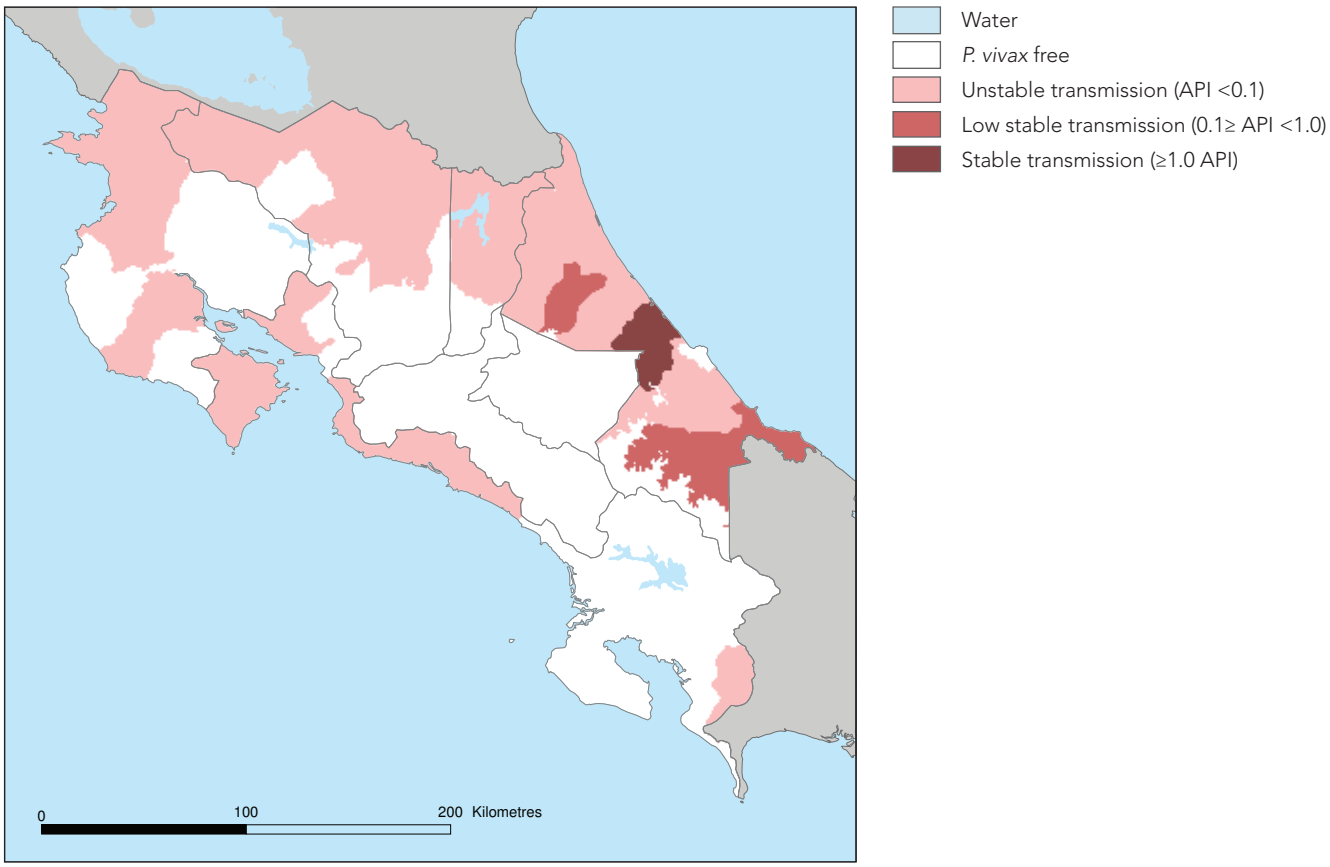
Source: World Bank, World Development Indicators

Human Population Density



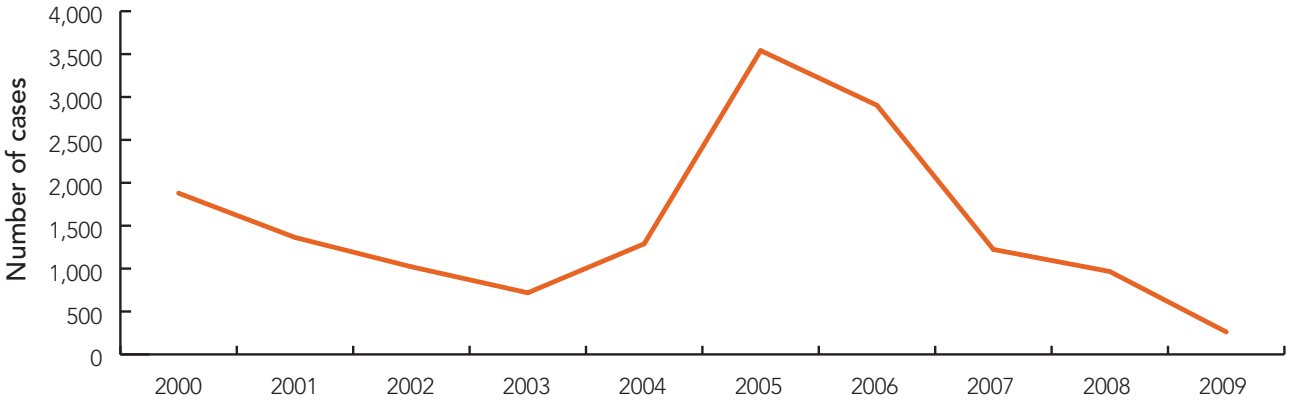
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

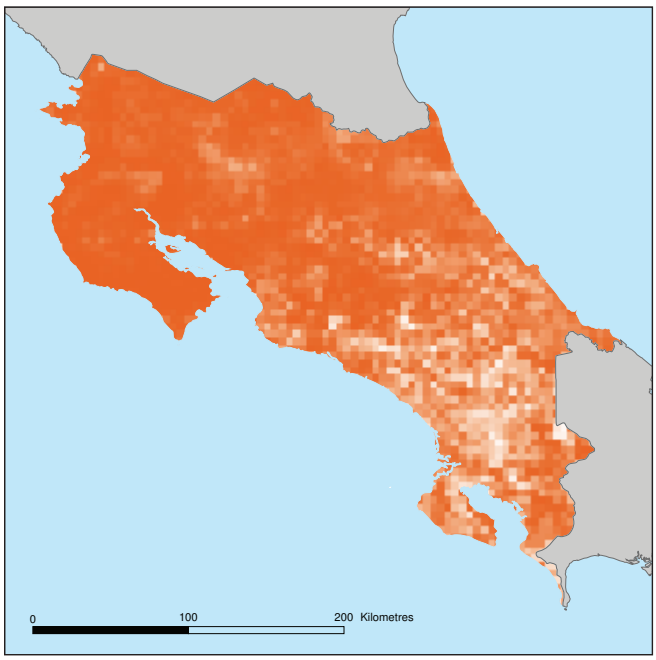
Reported Malaria Cases



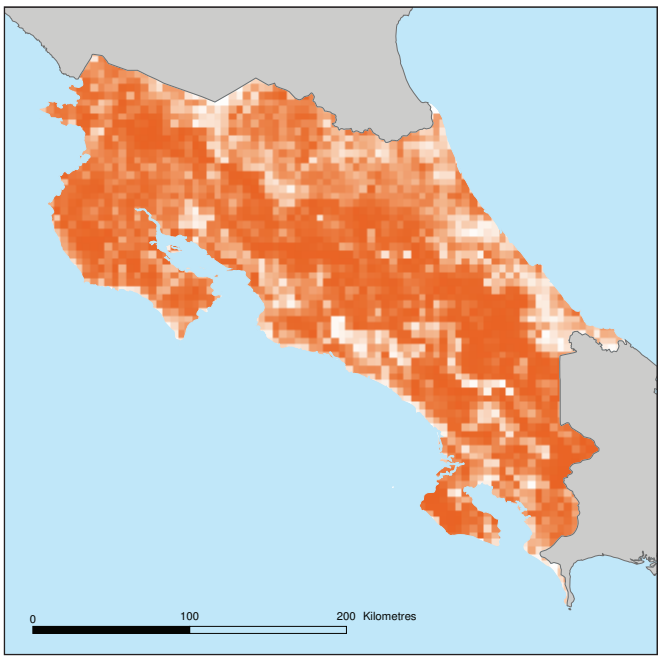
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

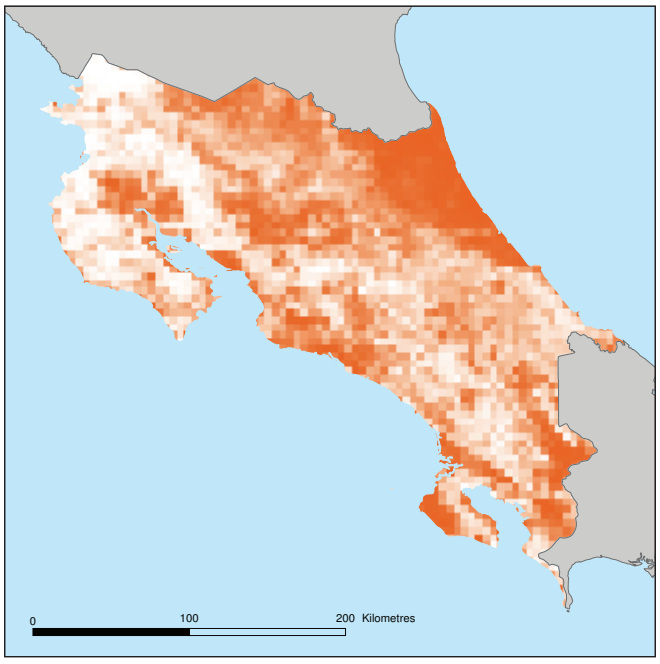
1. *Anopheles albimanus*



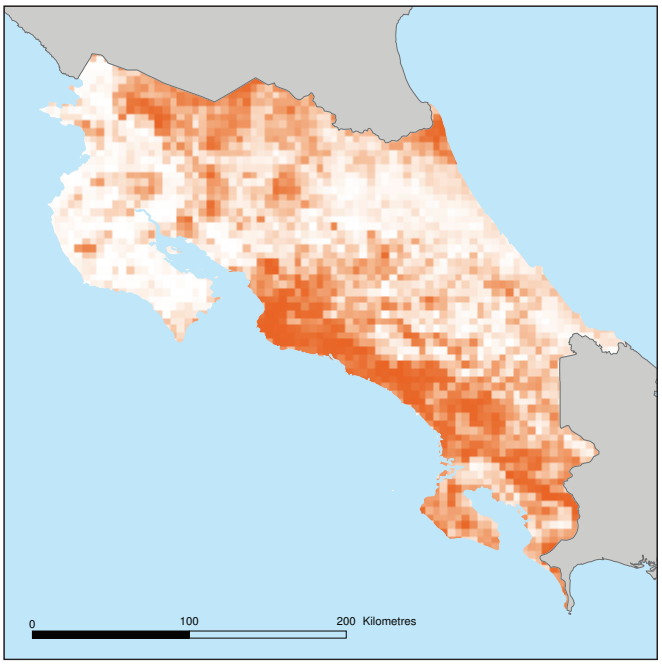
2. Pseudopuntipennis Complex



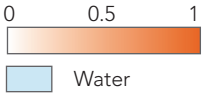
3. *Anopheles aquasalis*



4. *Anopheles marajoara*



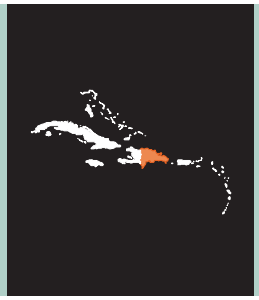
Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudo-punctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) aquasalis Curry, 1932	Variable depending on location	Sunlit habitats with emergent vegetation in coastal areas	Both	Both	Exophilic	Dusk/ night
Anopheles (Nyssorhynchus) marajoara Galvão & Damasceno, 1942	Variable depending on location and abundance	Lowland, wetland, secondary forest and human intervention areas	Both	Both	Exophilic	Dusk/ night
Anopheles (Nyssorhynchus) albitarsis species complex	Present but non or minor vector in Costa Rica					



DOMINICAN REPUBLIC

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	1,643
Deaths from malaria	14
Population at risk (%) (Total population: 10.2 million)	79
Annual parasite index (cases/1,000 total population/year)	0.1
Slide positivity rate (%)	0.4

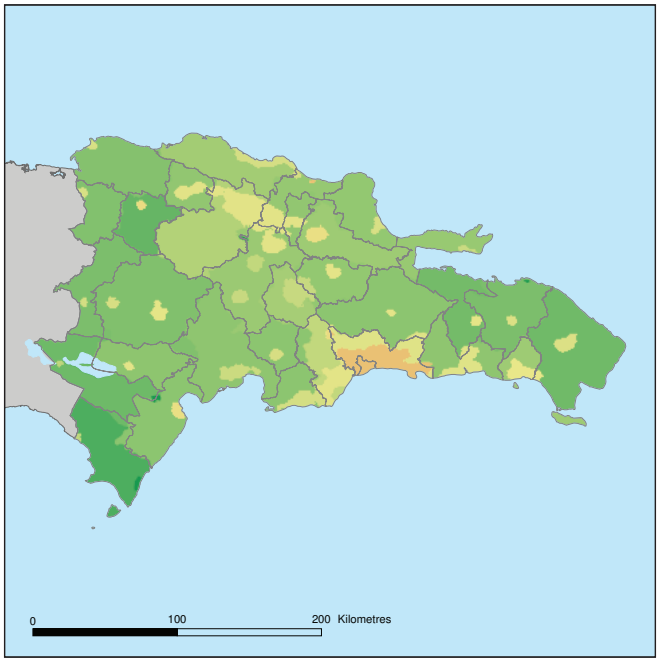
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	4,860
Country income level	Upper middle
Annual per capita health expenditure (US$)	271
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	59
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

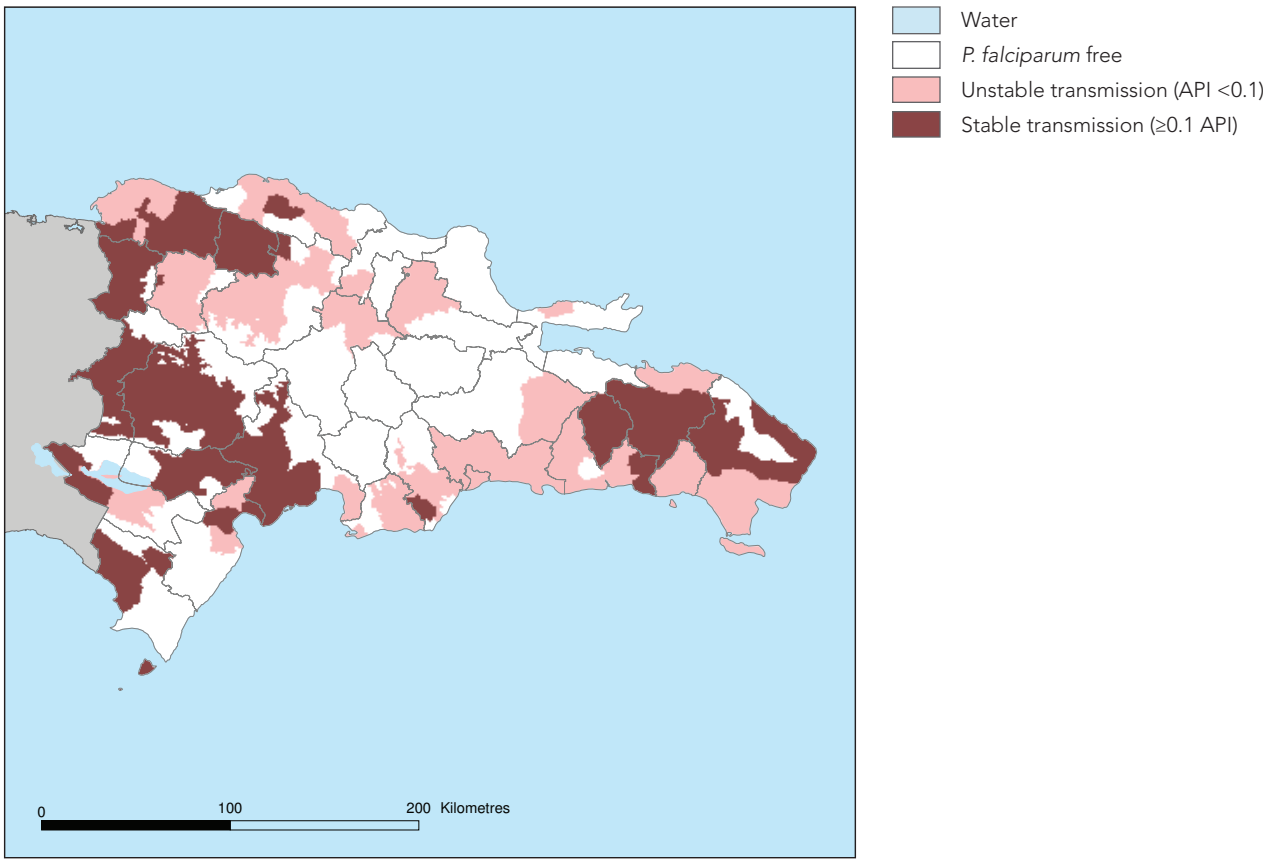
Water

Strategic Program Goals for Elimination

- Reduce malaria morbidity and mortality rates in the 14 highly-endemic municipalities by 2012
- Reach a zero malaria mortality rate by 2012
- To eliminate malaria from the island of Hispaniola by 2020

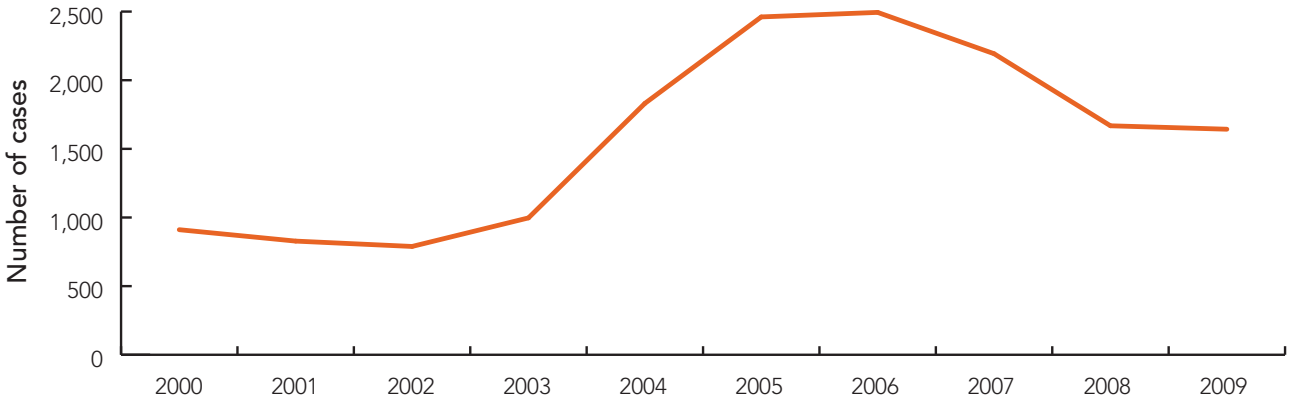
Malaria Transmission Limits

Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

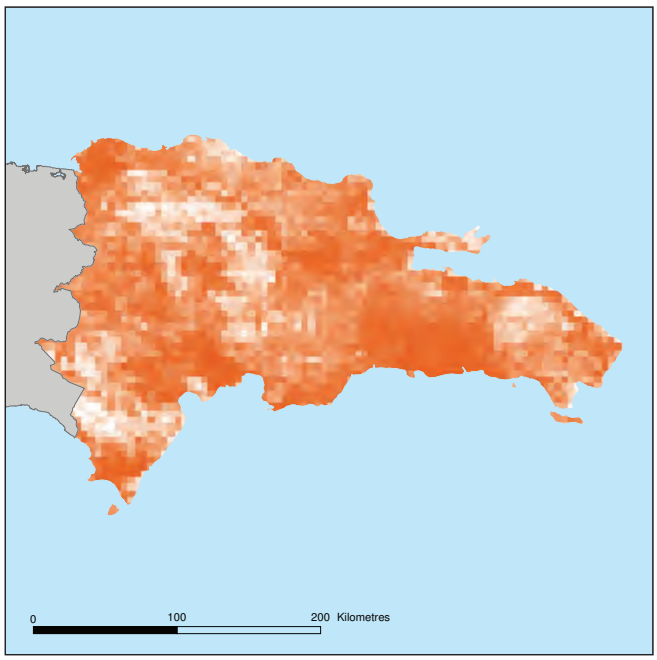
Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles albimanus*



Probability of occurrence scale

0 0.5 1

Water

This map shows the predicted probability of occurrence of this vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/night
Anopheles (Nyssorhynchus) aquasalis Curry, 1932	Present but non or minor vector in Dominican Republic					

EL SALVADOR

Overview

Malaria at a Glance

Reported cases of malaria (95% *P. vivax*)	20
Deaths from malaria	0
Population at risk (%) (Total population: 6.2 million)	83
Annual parasite index (cases/1,000 total population/year)	0.003
Slide positivity rate (%)	0.02

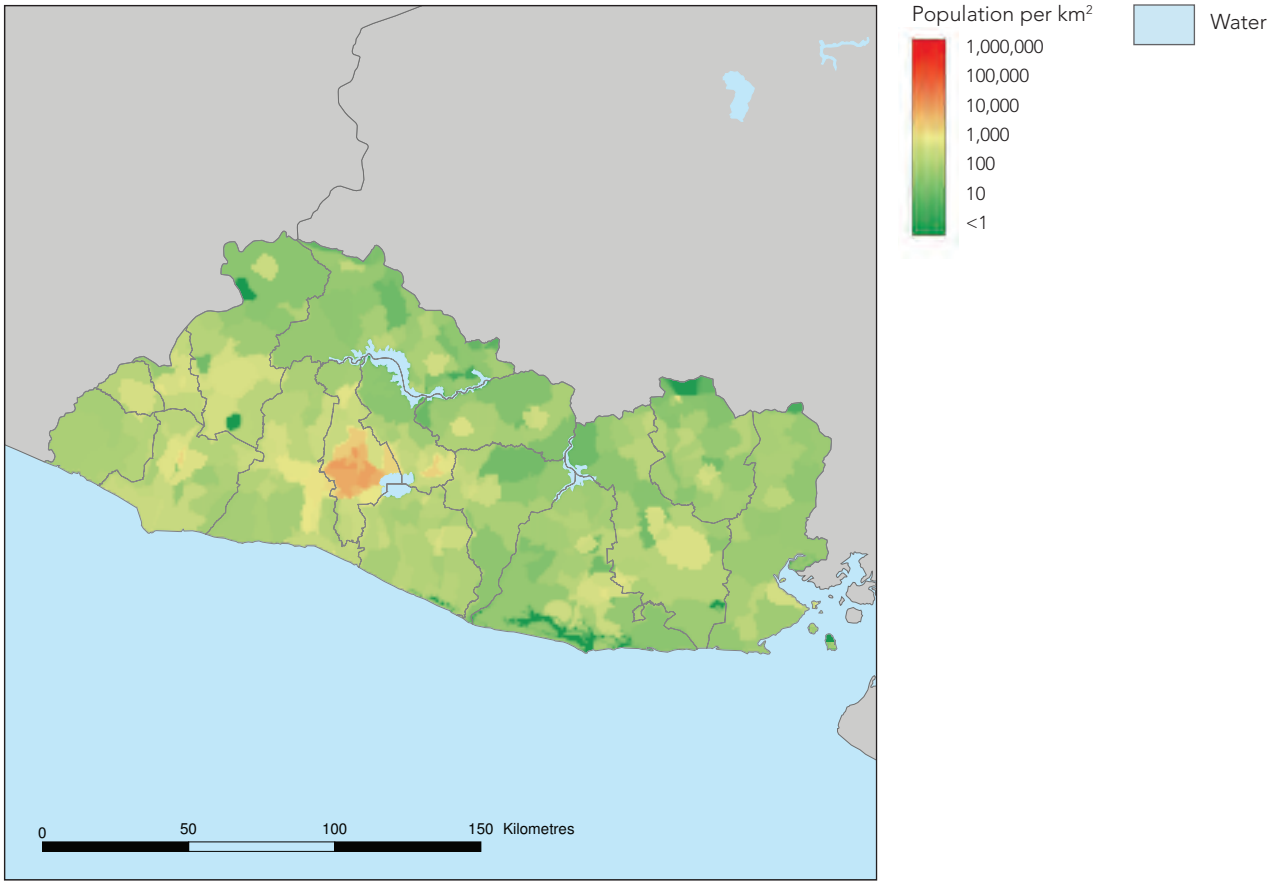
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	3,360
Country income level	Lower middle
Annual per capita health expenditure (US$)	229
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	40
Life expectancy (years)	71

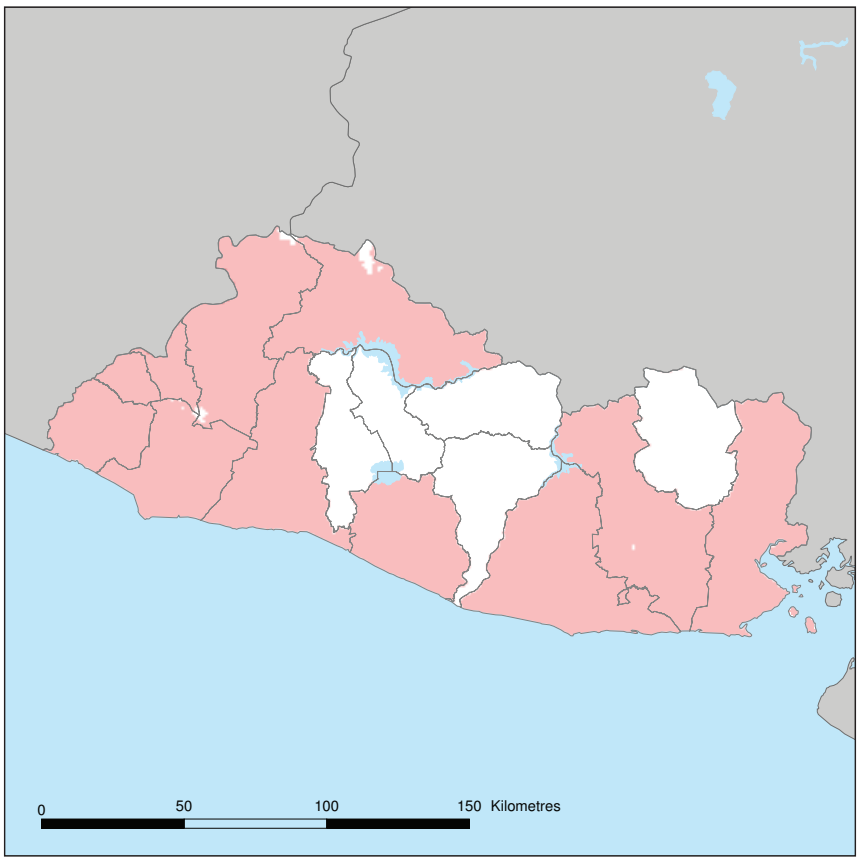
Source: World Bank, World Development Indicators

Human Population Density



Malaria Transmission Limits

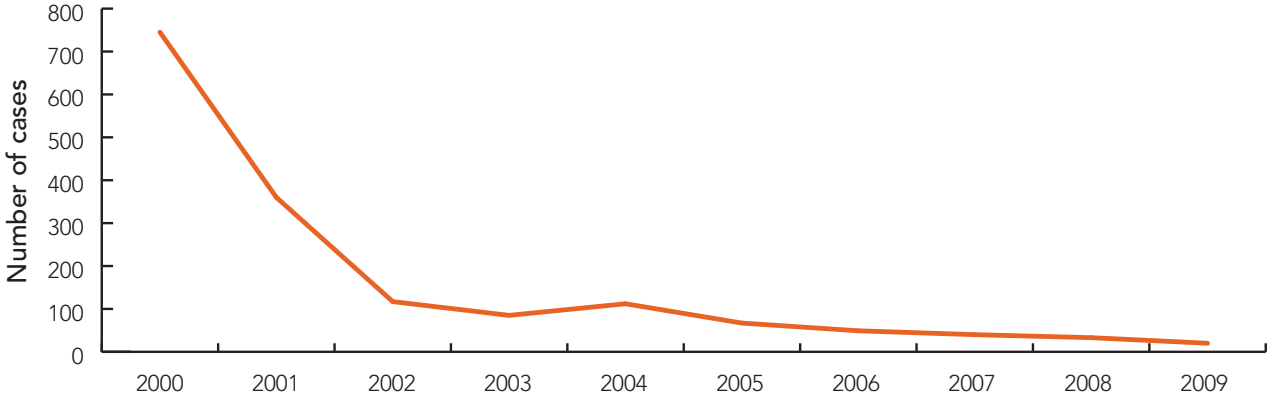
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

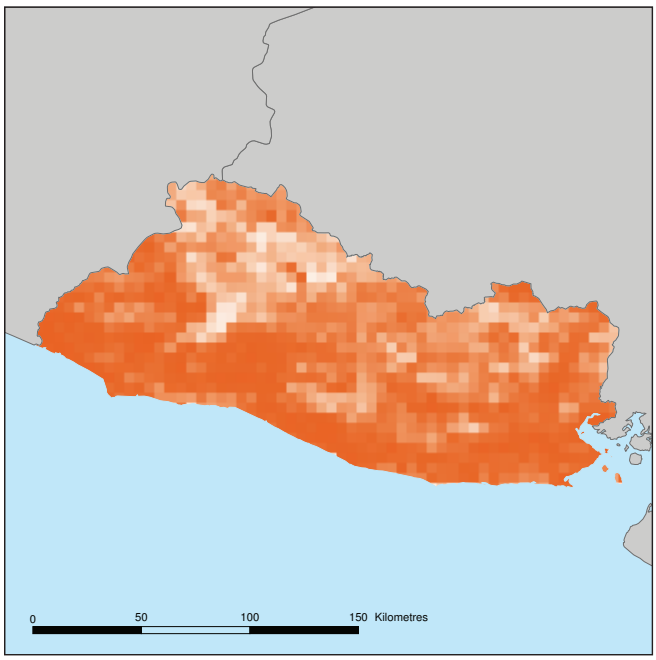
Reported Malaria Cases



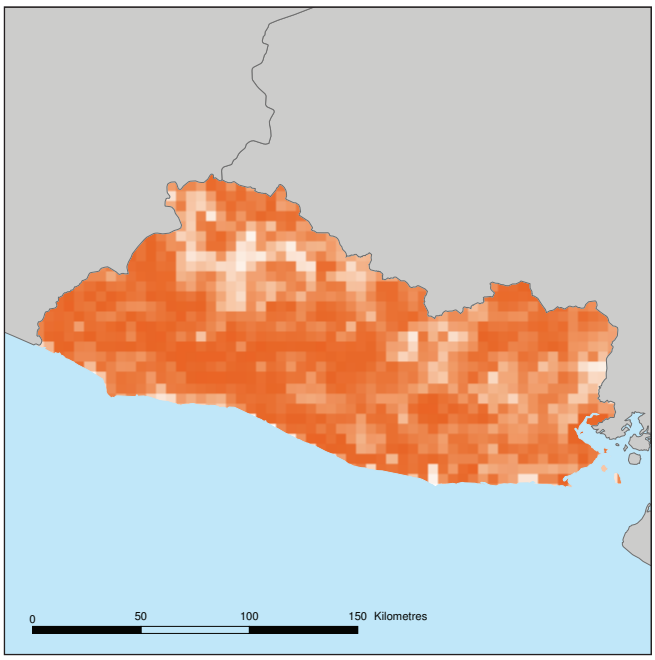
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

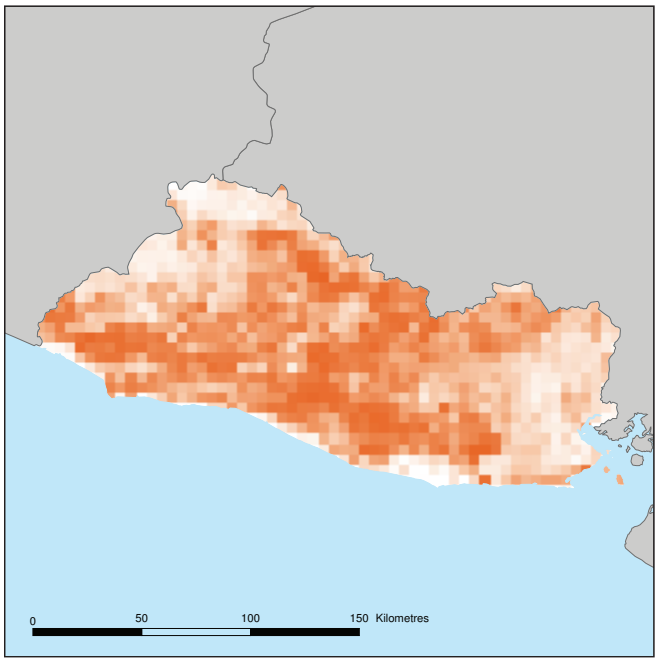
1. *Anopheles albimanus*



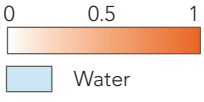
2. Pseudopunctipennis Complex



3. *Anopheles darlingi*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudo-punctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) darlingi Root, 1926	Important vector throughout its range	Rural lowland forest	Anthropophilic	Both	Exophilic	Dusk/ night/ dawn

MEXICO

Overview

Malaria at a Glance

Reported cases of malaria (99% *P. vivax*)	2,703
Deaths from malaria	0
Population at risk (%) (Total population: 108.5 million)	5
Annual parasite index (cases/1,000 total population/year)	0.04
Slide positivity rate (%)	0.2

Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	9,330
Country income level	Upper middle
Annual per capita health expenditure (US$)	515
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	52
Life expectancy (years)	75

Source: World Bank, World Development Indicators

Human Population Density

Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goals for Elimination

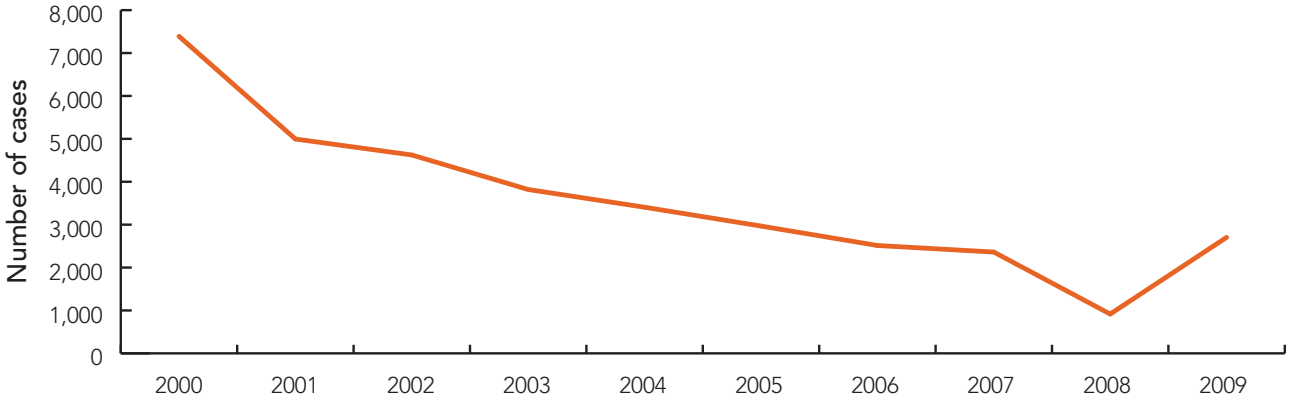
- Reduce malaria morbidity by 15% per year from 2006 to 2012, or a 55% total reduction over the same period
- Control imported cases of *P. falciparum* to 22 or less per year
- Reduce and limit the transmission of indigenous cases of *P. vivax* to fewer than 500 towns by 2012
- Maintain an annual case detection coverage rate of 90% of all cases in the population at risk

Malaria Transmission Limits

Plasmodium vivax

P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

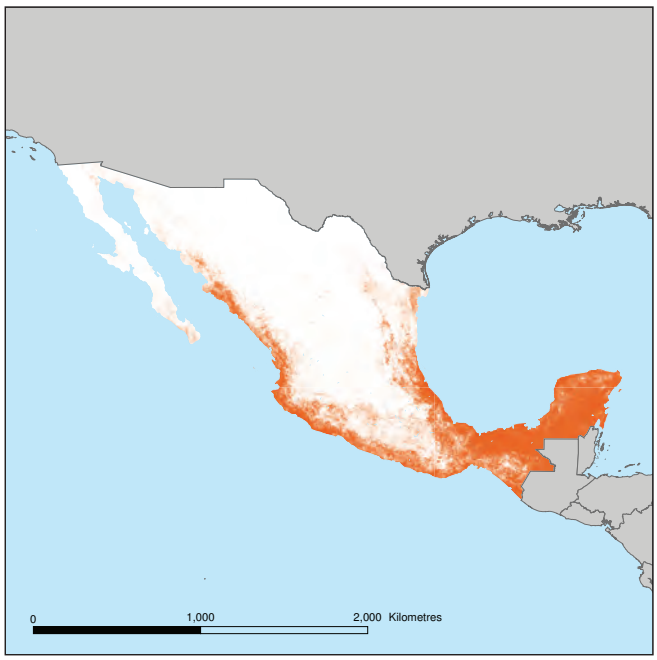
Reported Malaria Cases



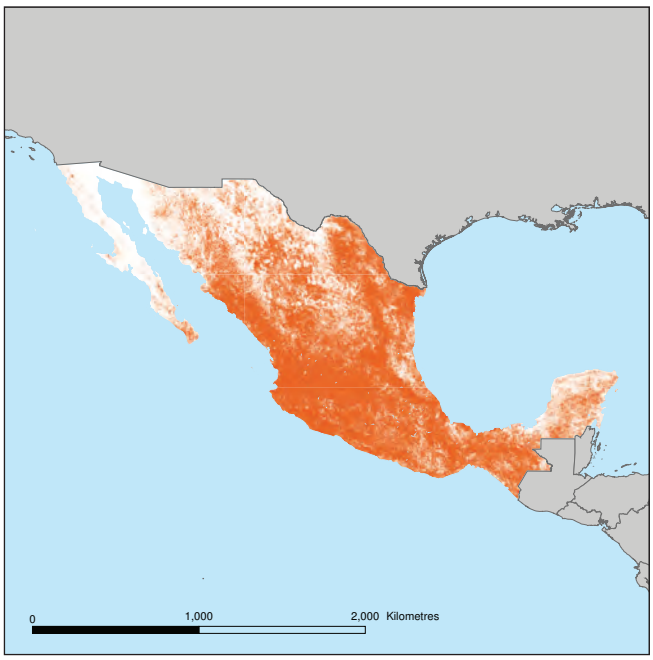
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

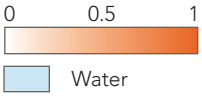
1. *Anopheles albimanus*



2. Pseudopunctipennis Complex



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudopunctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) darlingi Root, 1926	Present but non or minor vector in Mexico					

NICARAGUA

Overview

Malaria at a Glance

Reported cases of malaria (85% *P. vivax*)	610
Deaths from malaria	0
Population at risk (%) (Total population: 5.8 million)	83
Annual parasite index (cases/1,000 total population/year)	0.1
Slide positivity rate (%)	0.1

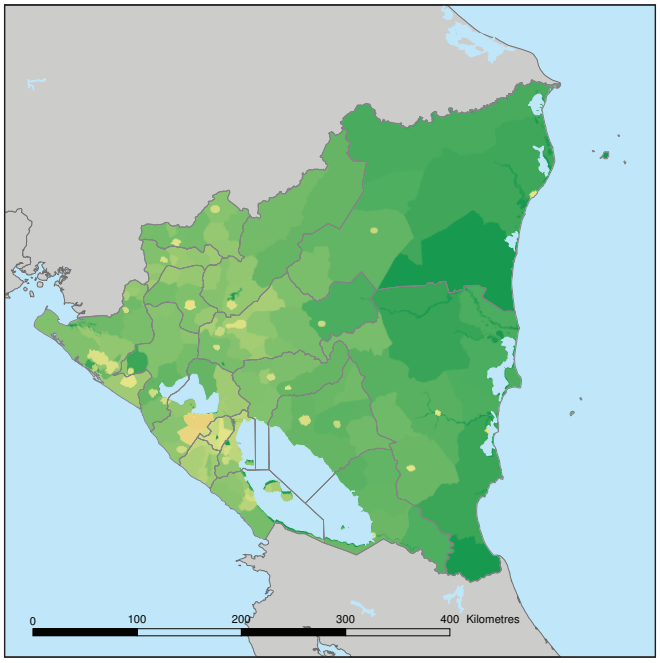
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,080
Country income level	Lower middle
Annual per capita health expenditure (US$)	105
Total health expenditure as % of GDP	9
Private health expenditure as % of total health expenditure	43
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

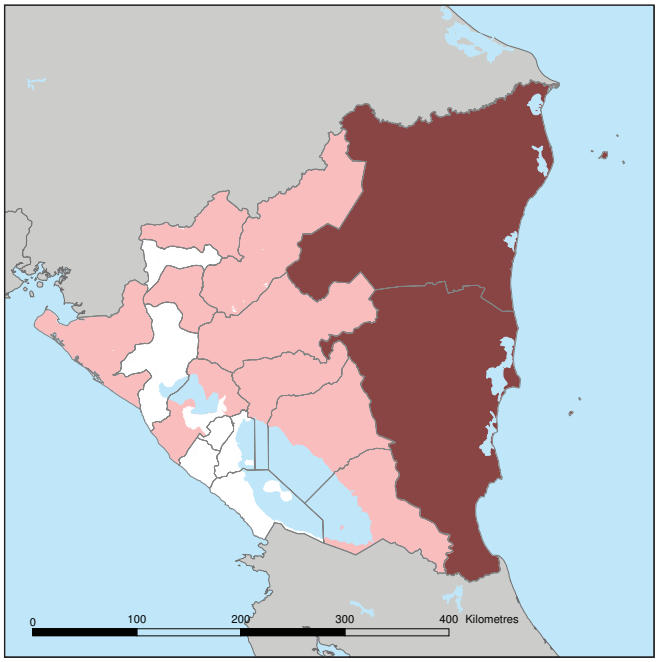
Water

Strategic Program Goal for Elimination

By 2014, strengthen current efforts to eliminate malaria in four municipalities, move to the pre-elimination phase in seven municipalities, and continue controlling malaria in 26 municipalities

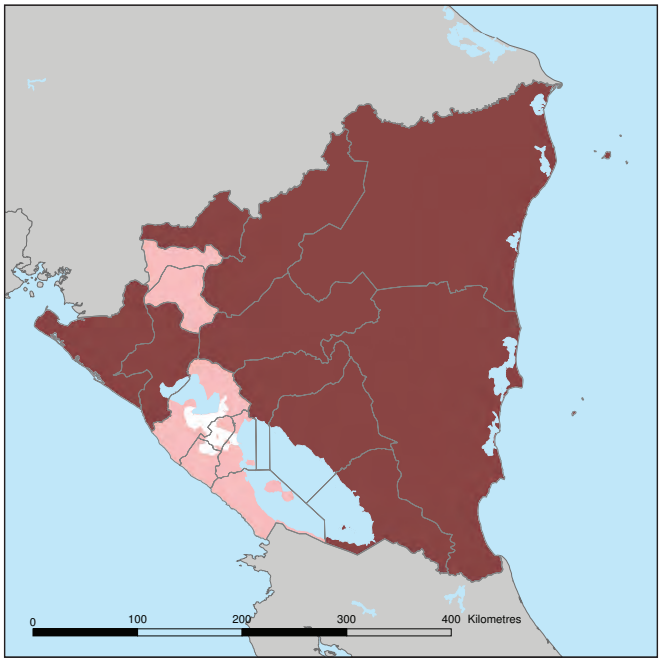
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

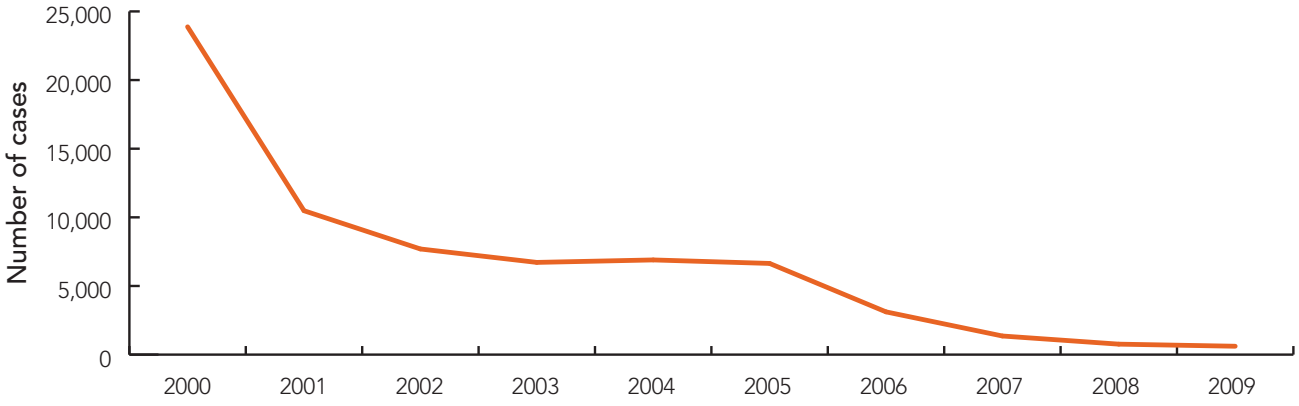
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/*P. vivax malaria* risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

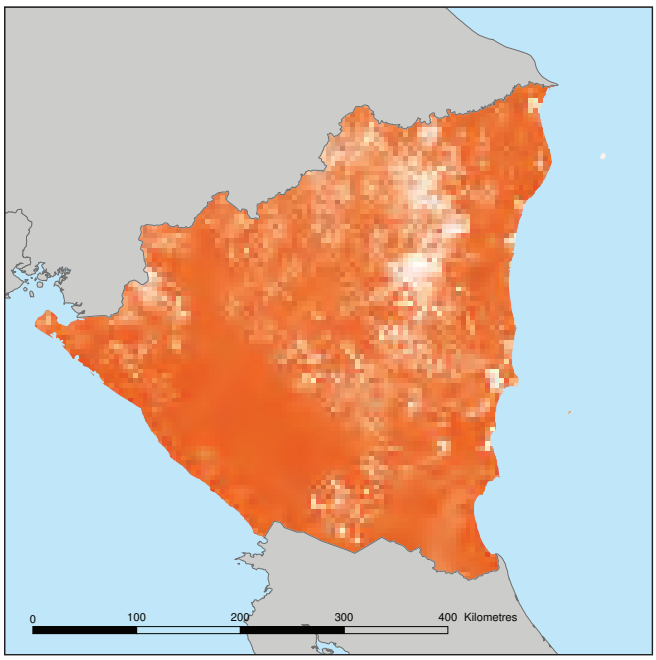
Reported Malaria Cases



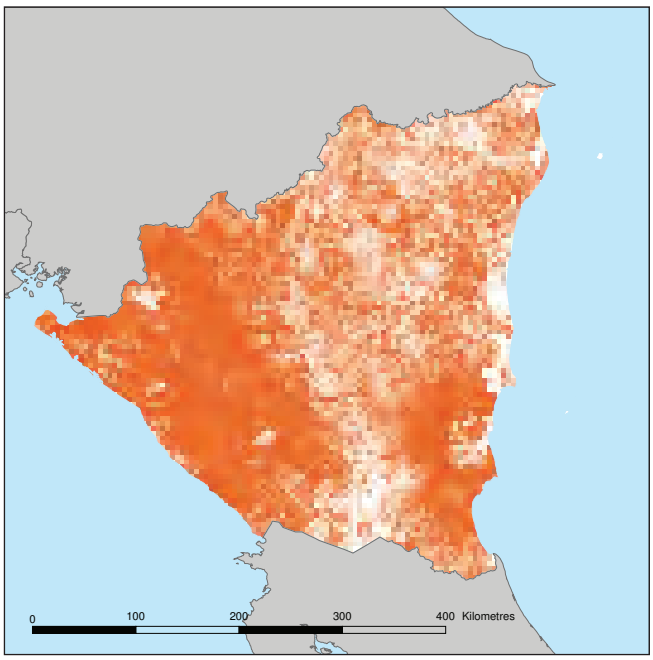
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

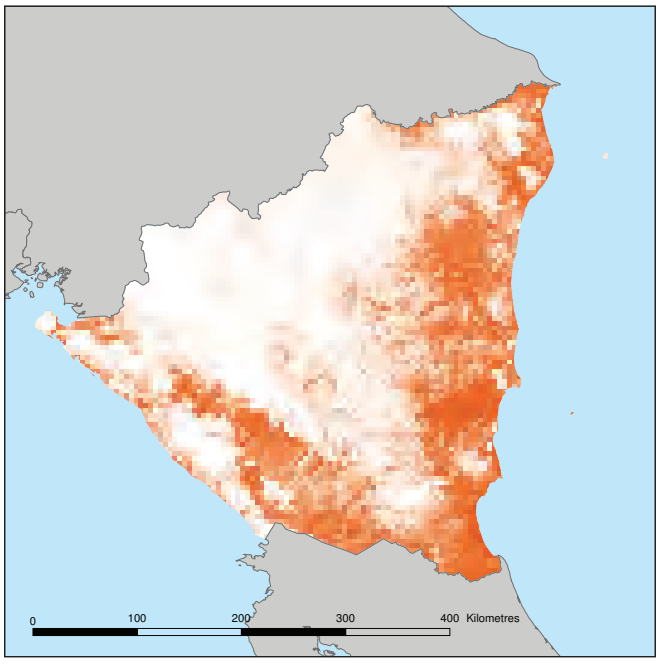
1. *Anopheles albimanus*



2. Pseudopunctipennis Complex



3. *Anopheles aquasalis*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudo-punctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) aquasalis Curry, 1932	Variable depending on location	Sunlit habitats with emergent vegetation in coastal areas	Both	Both	Exophilic	Dusk/ night

PANAMA

Overview

Malaria at a Glance

Reported cases of malaria (99% *P. vivax*)	770
Deaths from malaria	N/A
Population at risk (%) (Total population: 3.5 million)	96
Annual parasite index (cases/1,000 total population/year)	0.2
Slide positivity rate (%)	0.5

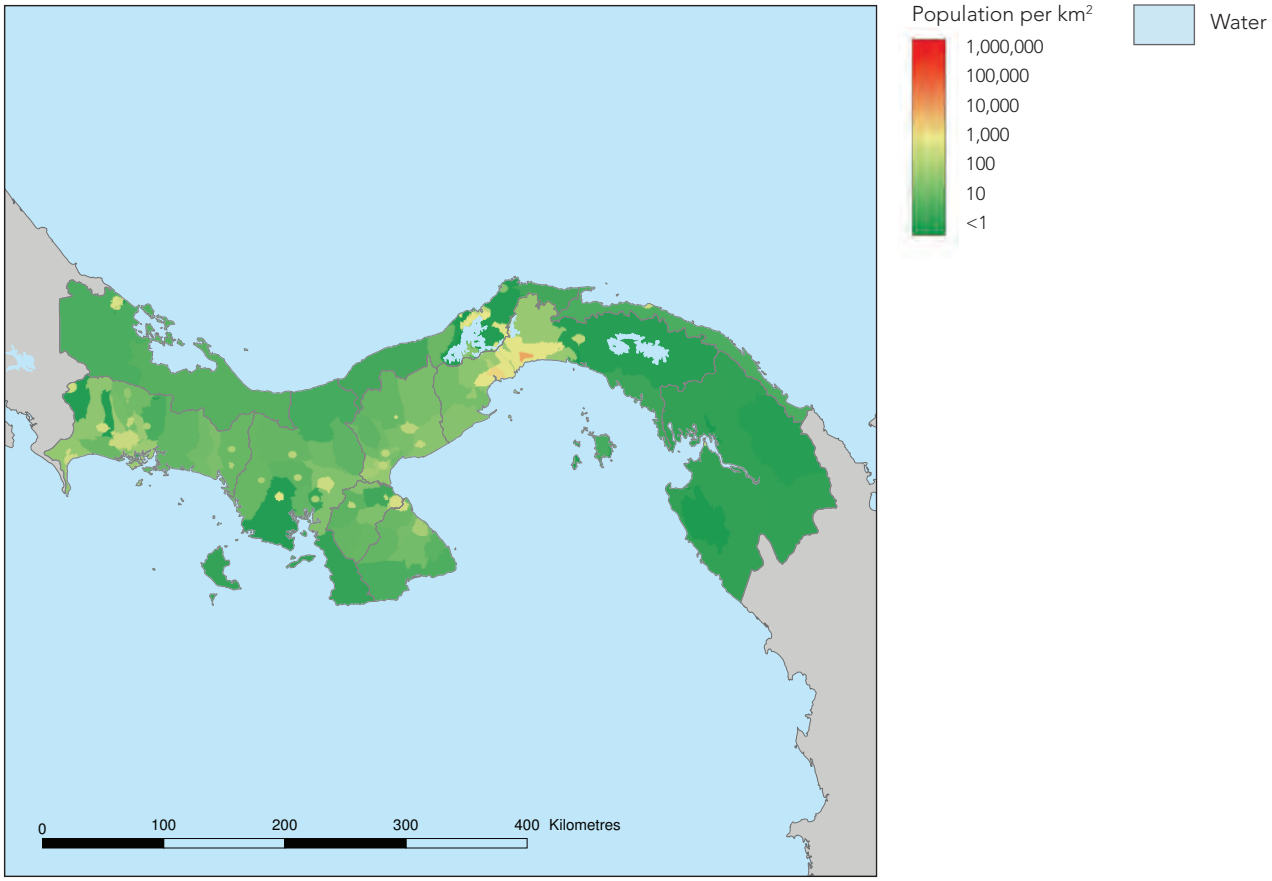
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	6,980
Country income level	Upper middle
Annual per capita health expenditure (US$)	591
Total health expenditure as % of GDP	8
Private health expenditure as % of total health expenditure	28
Life expectancy (years)	76

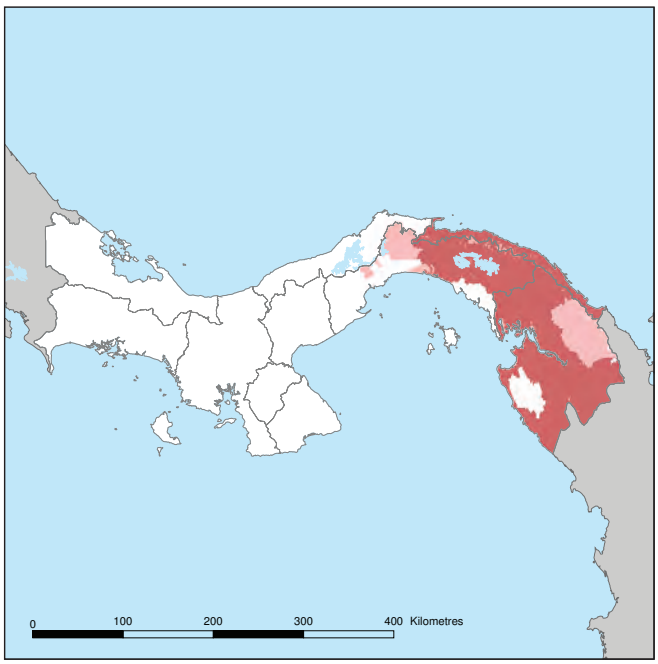
Source: World Bank, World Development Indicators

Human Population Density



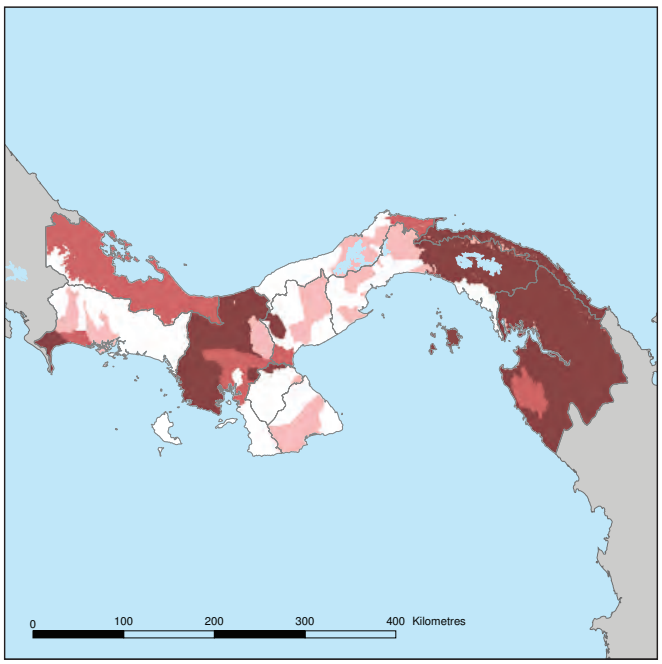
Malaria Transmission Limits

Plasmodium falciparum



Water
P. falciparum free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

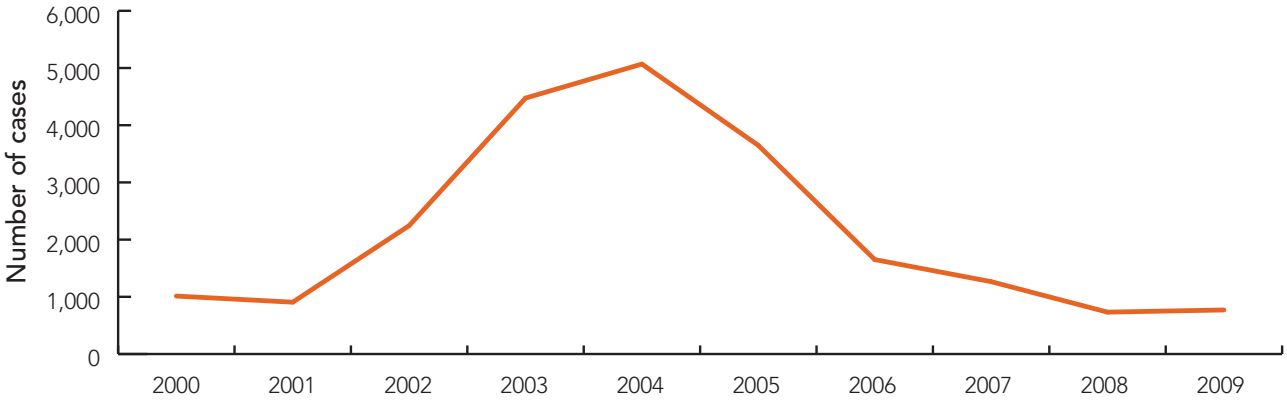
Plasmodium vivax



Water
P. vivax free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

P. falciparum/*P. vivax* malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

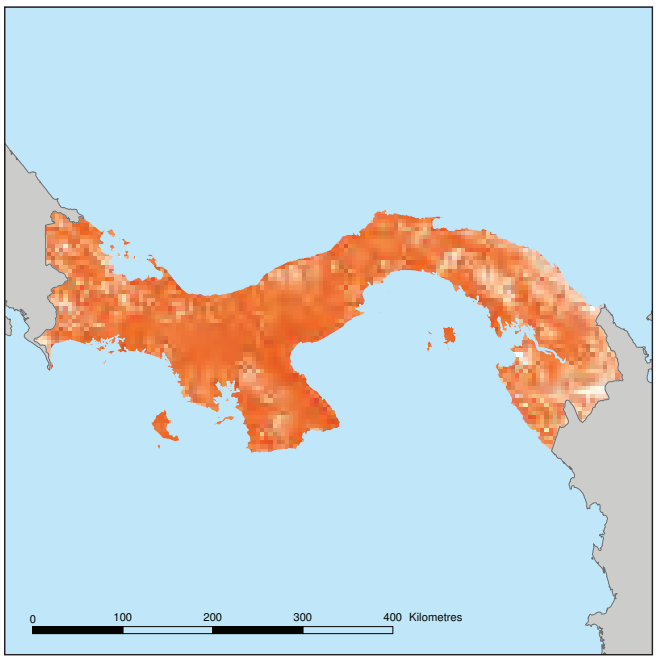
Reported Malaria Cases



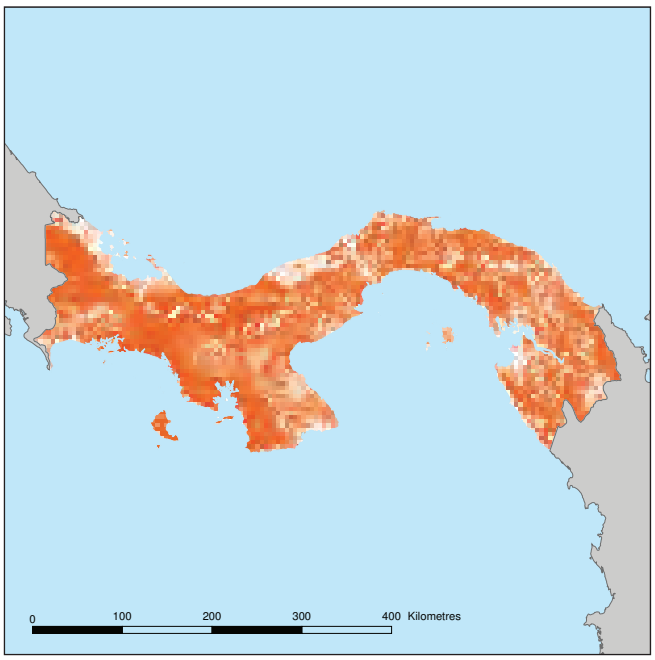
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

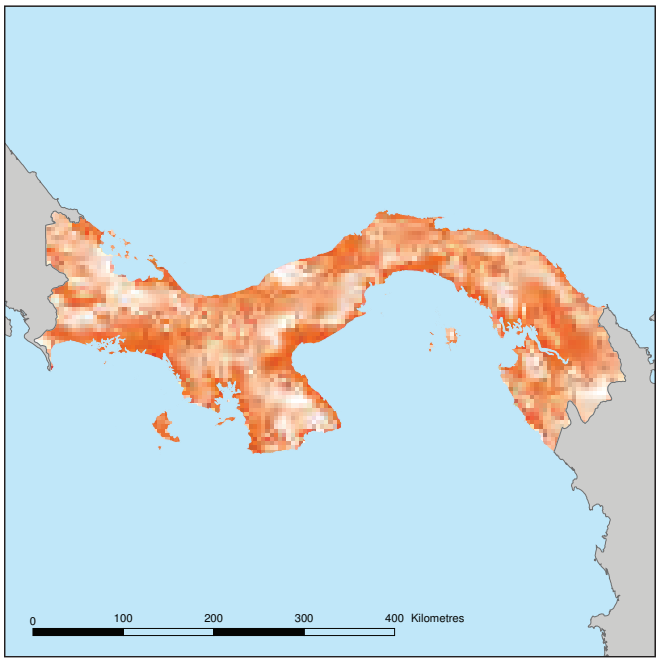
1. *Anopheles albimanus*



2. Pseudopunctipennis Complex



3. *Anopheles aquasalis*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) albimanus Wiedemann, 1820	Variable depending on location	Sunlit ponds, river margins, mangroves and rice fields	Both	Both	Exophilic	Dusk/ night
Anopheles (Anopheles) pseudopunctipennis species complex	Malaria vector in a range of locations including high altitudes	Sun-exposed, shallow streams or pools with abundant filamentous algae	Both	Both	Exophilic/ both	Night
Anopheles (Nyssorhynchus) aquasalis Curry, 1932	Variable depending on location	Sunlit habitats with emergent vegetation in coastal areas	Both	Both	Exophilic	Dusk/ night
Anopheles (Nyssorhynchus) albitarsis species complex; *Anopheles (Nyssorhynchus) marajoara* Galvão & Damasceno, 1942	Present but non or minor vector in Panama					

PARAGUAY

Overview

Malaria at a Glance

Reported cases of malaria (89% *P. vivax*)	91
Deaths from malaria	0
Population at risk (%) (Total population: 6.5 million)	68
Annual parasite index (cases/1,000 total population/year)	0.01
Slide positivity rate (%)	0.1

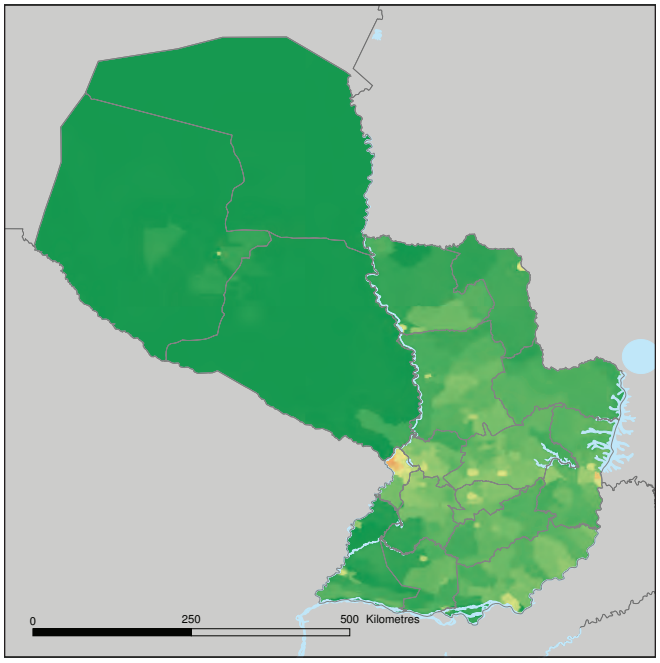
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	2,940
Country income level	Lower middle
Annual per capita health expenditure (US$)	159
Total health expenditure as % of GDP	7
Private health expenditure as % of total health expenditure	57
Life expectancy (years)	72

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

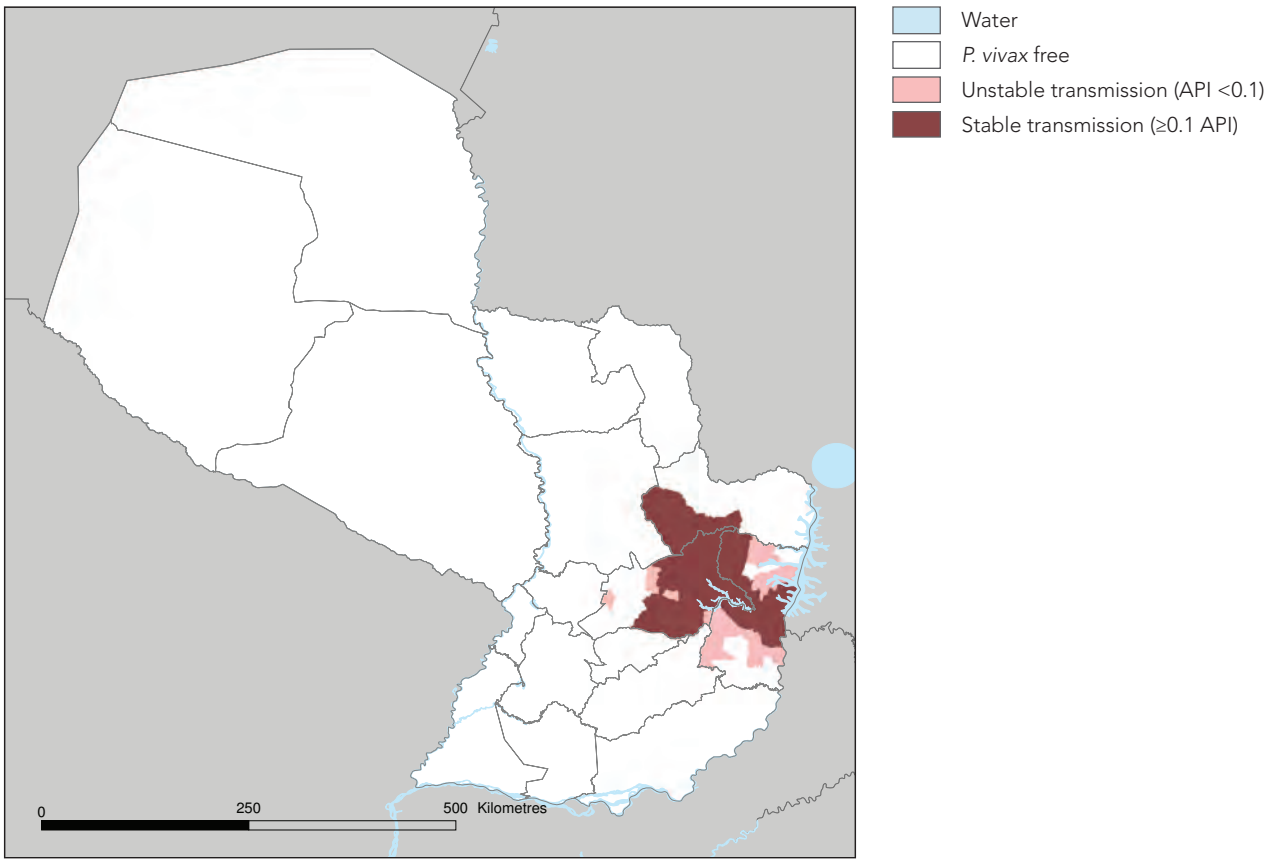
Water

Strategic Program Goal for Elimination

Achieve an 80% reduction in the incidence of malaria between 2008 to 2013

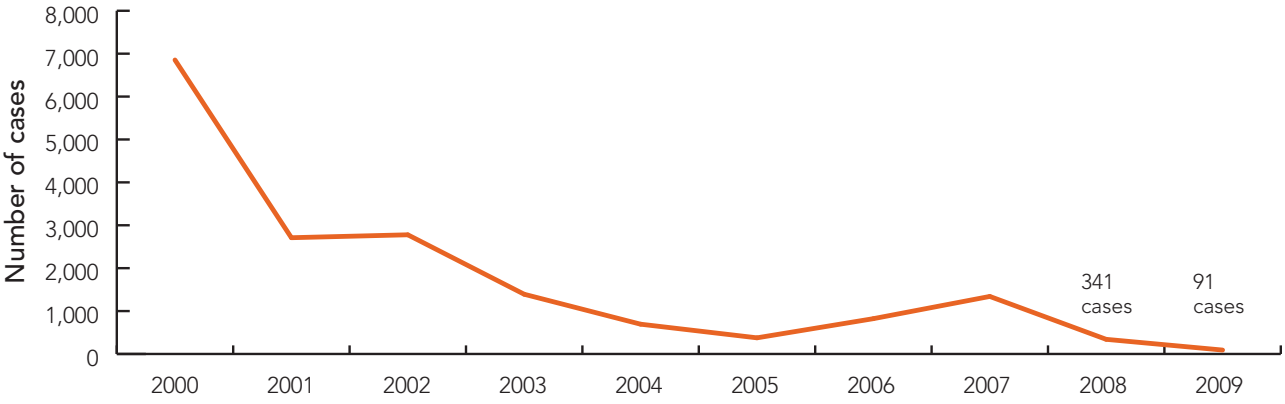
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

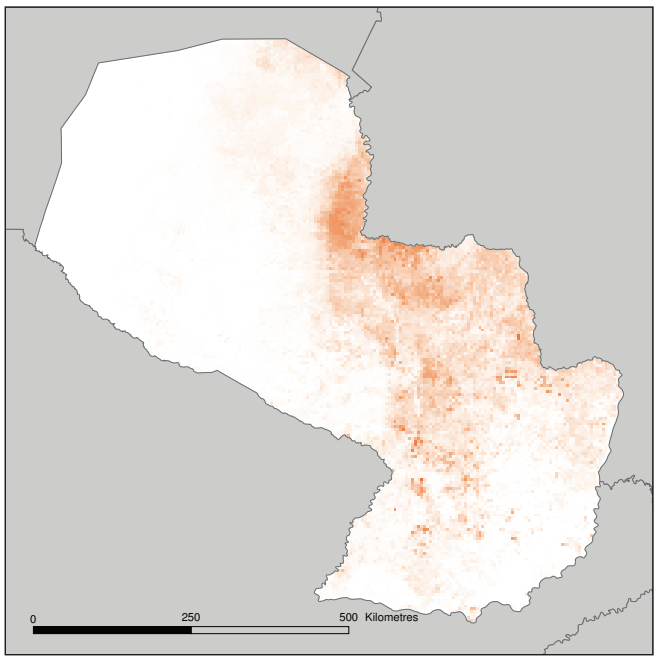
Reported Malaria Cases



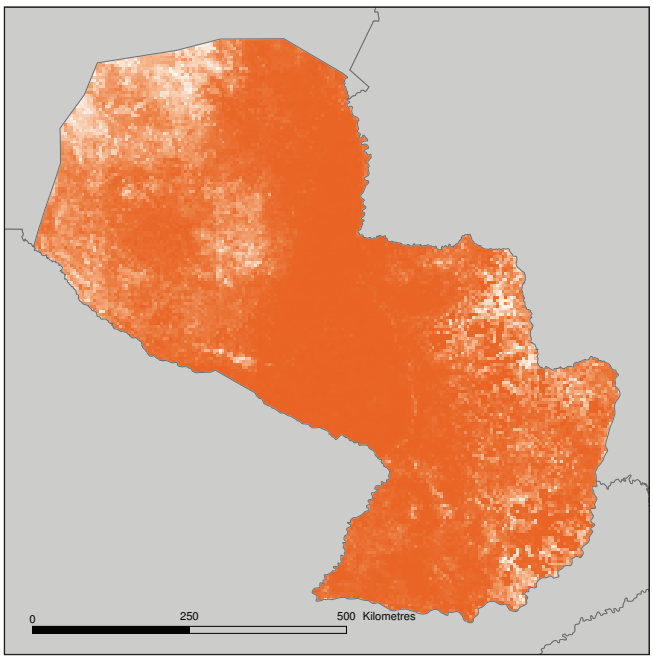
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles darlingi*



2. Albitarsis Complex



Probability of occurrence scale

0 0.5 1

Water

Anopheles marajoara is a member of the Albitarsis Complex, however it is not included in this map.

These maps show the predicted probability of occurrence of each vector species.

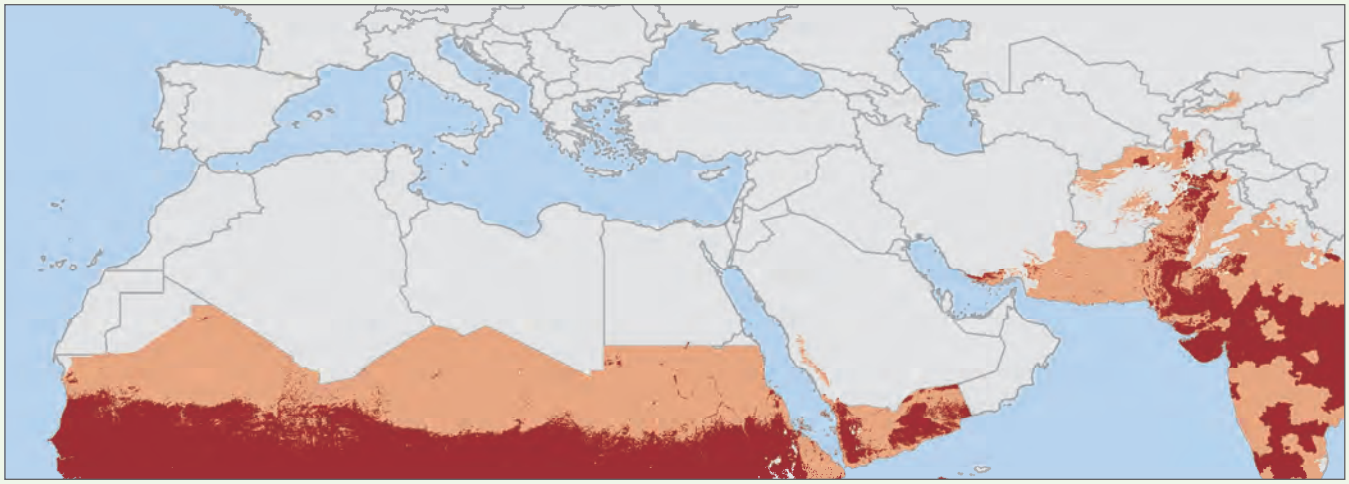
Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Nyssorhynchus) darlingi Root, 1926	Important vector throughout its range	Rural lowland forest	Anthropophilic	Both	Exophilic	Dusk/ night/ dawn
Anopheles (Nyssorhynchus) albitarsis species complex	Variable depending on location	Sunlit lagoons, lakes, rice fields and brick pits	Both	Both	Exophilic	Dusk/ night

North Africa, Europe, Middle East, Central Asia

Algeria | Azerbaijan | Georgia | Iran | Iraq | Kyrgyzstan
Saudi Arabia | Tajikistan | Turkey | Uzbekistan

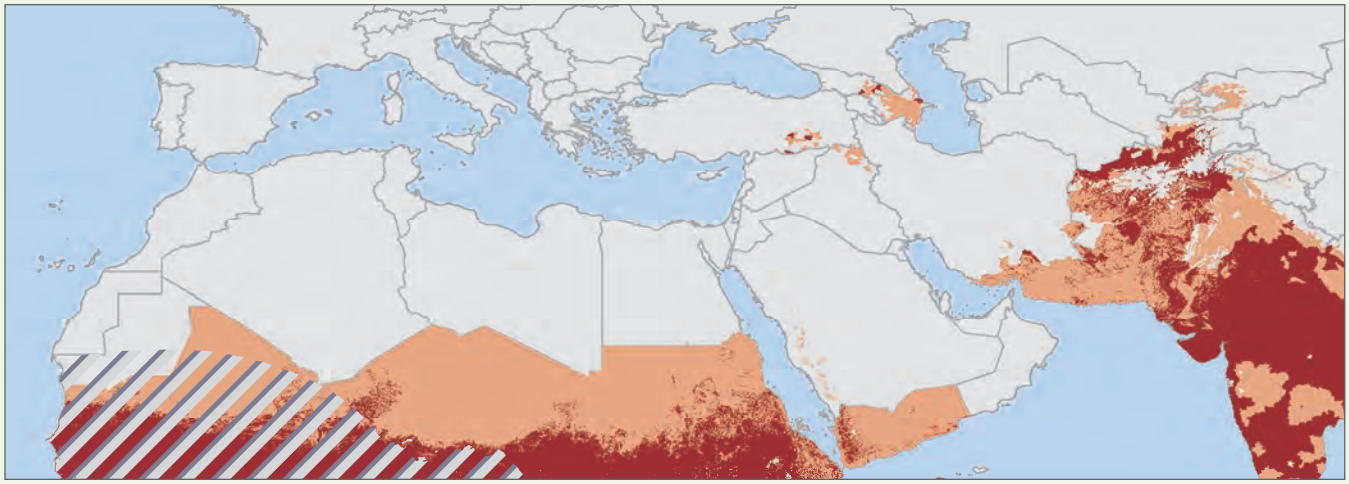
Malaria Transmission Limits for *Plasmodium falciparum*



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

Malaria Transmission Limits for *Plasmodium vivax*



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas. Areas where Duffy negative prevalence was estimated as ≥90% are hatched, indicating where the populations at risk are modulated most significantly by the presence of this genetic trait.

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)
- Duffy negativity ≥90%

ALGERIA

Overview

Malaria at a Glance

Reported cases of malaria	3
Deaths from malaria	0
Population at risk (%) (Total population: 35.4 million)	7
Annual parasite index (cases/1,000 total population/year)	0.005
Slide positivity rate (%)	1.6

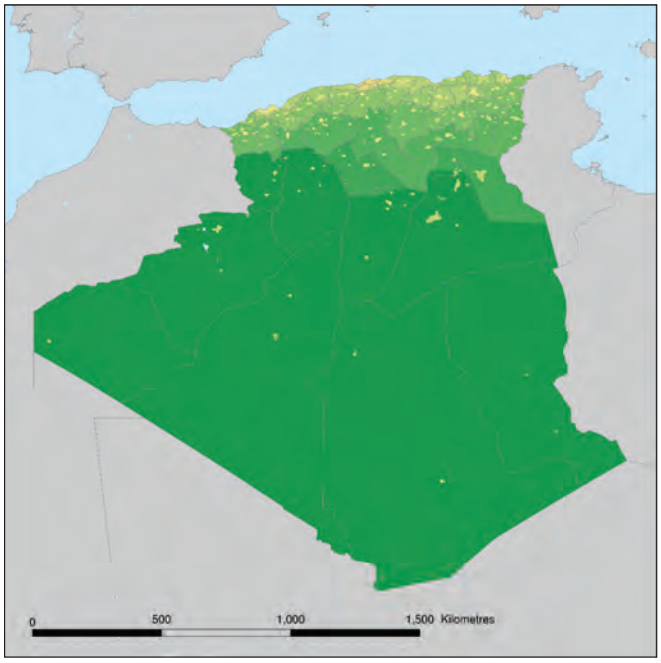
Source: WHO, World Malaria Report 2010, 2009

Health and Economic Indicators

GNI per capita (US$)	4,460
Country income level	Upper middle
Annual per capita health expenditure (US$)	268
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	14
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goal for Elimination

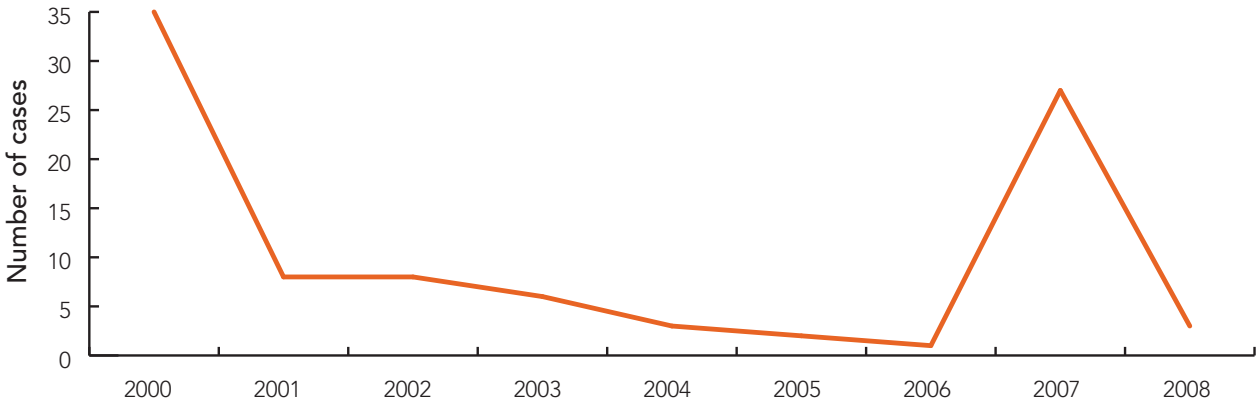
National malaria elimination by 2015

Malaria Transmission Limits

Malaria transmission risk is too low to generate maps. The World Health Organization classifies Algeria in the elimination phase.

Source: Roll Back Malaria. (2008). Global Malaria Action Plan

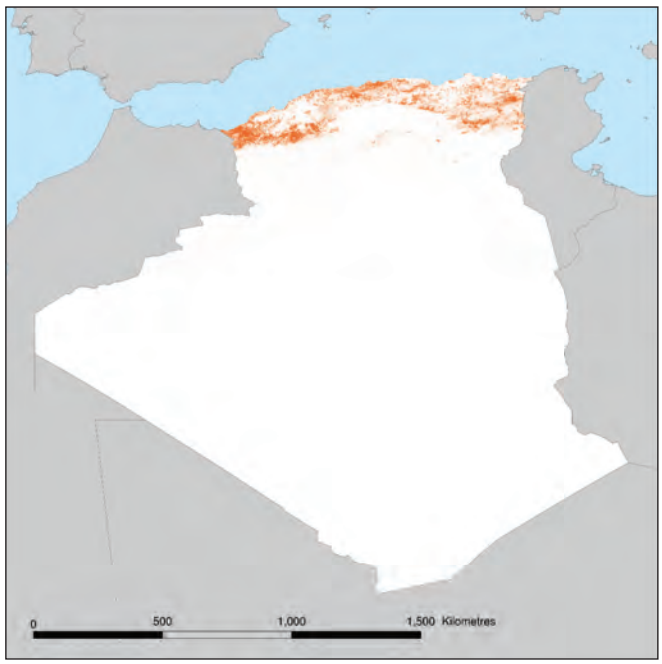
Reported Malaria Cases



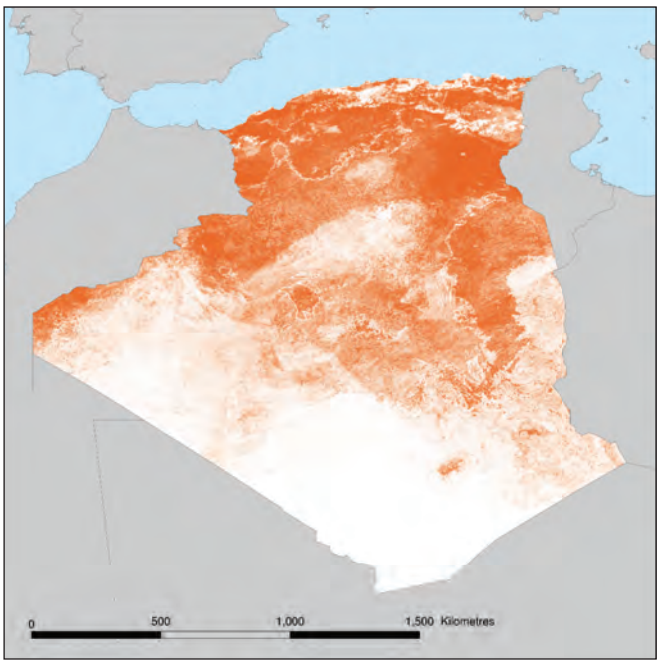
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

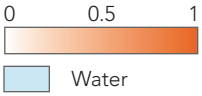
1. *Anopheles labranchiae*



2. *Anopheles sergentii*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) labranchiae Falleroni, 1926	Dominant vector species	Brackish warmer water and freshwater, marshes and lagoons, rice fields	Both	Both	Both	Dusk/ night
Anopheles (Cellia) sergentii species complex	Variable depending on location	Desert oases, irrigation channels with vegetation or algae and rice fields	Both	Data not available	Both	Data not available

AZERBAIJAN

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	78
Deaths from malaria	0
Population at risk (%) (Total population: 9 million)	2
Annual parasite index (cases/1,000 total population/year)	0.009
Slide positivity rate (%)	0.01

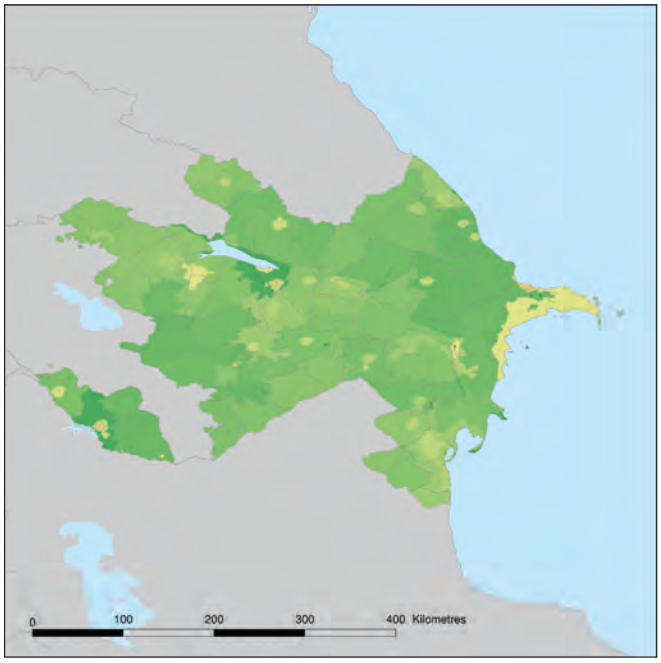
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	5,080
Country income level	Upper middle
Annual per capita health expenditure (US$)	285
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	76
Life expectancy (years)	70

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

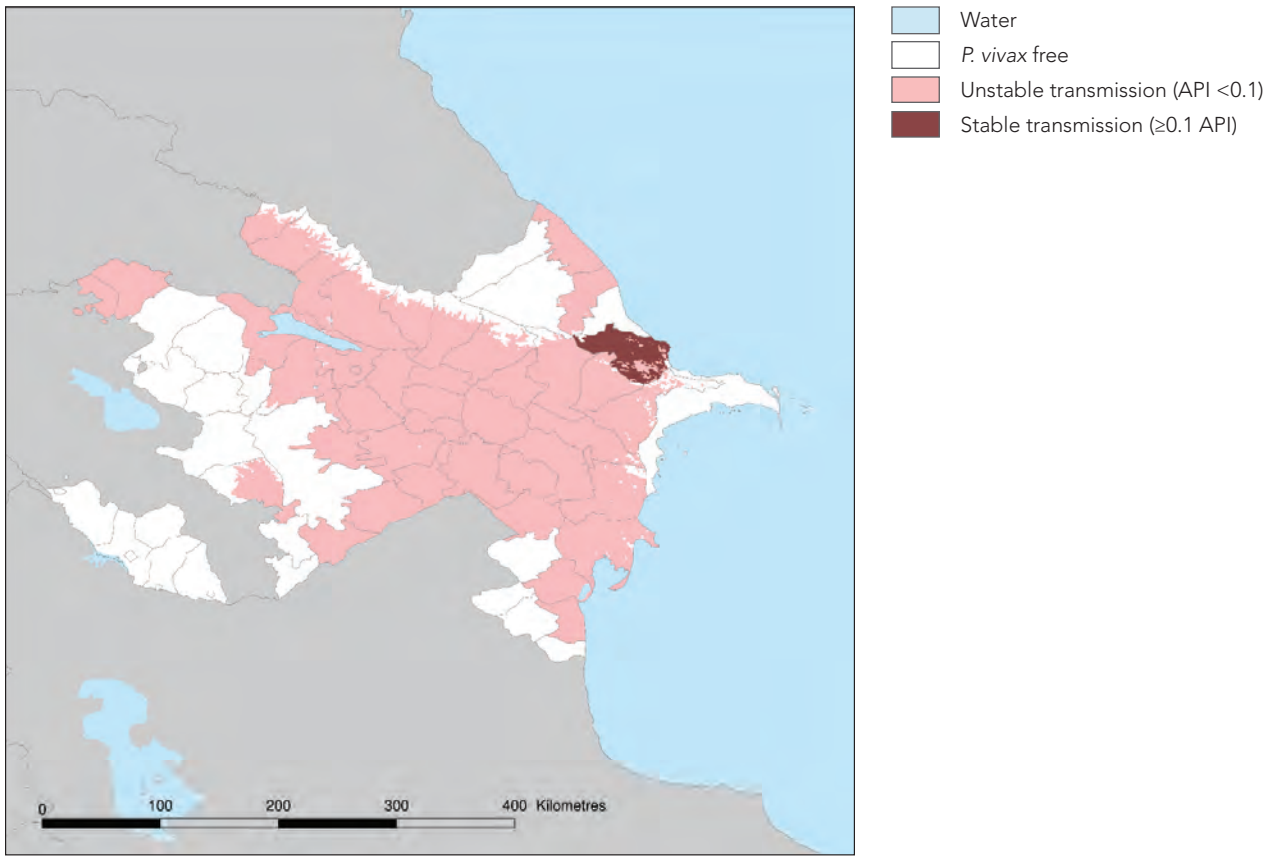
Water

Strategic Program Goals for Elimination

- To eliminate local transmission of *P. vivax* malaria by 2013
- To prevent reoccurrence of malaria in areas where transmission has been interrupted
- To strengthen surveillance to detect imported malaria

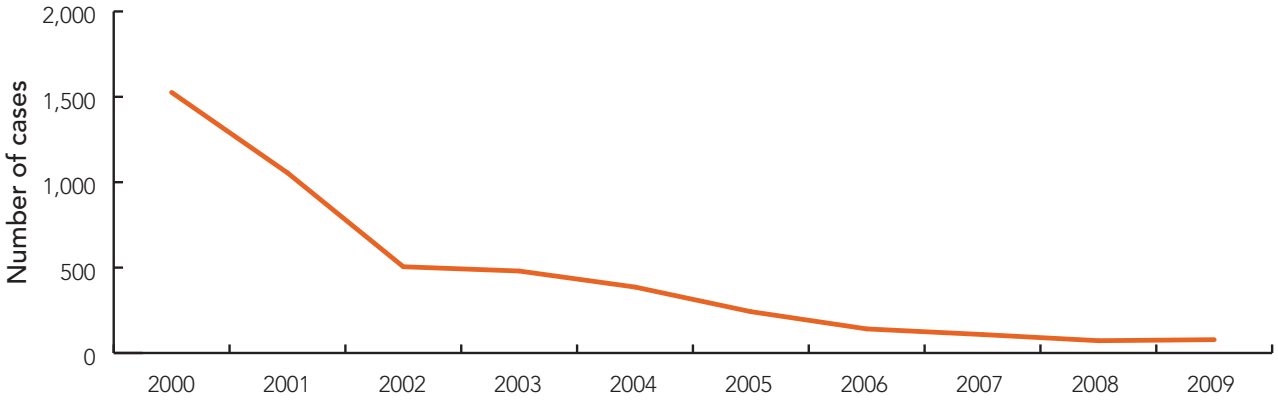
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

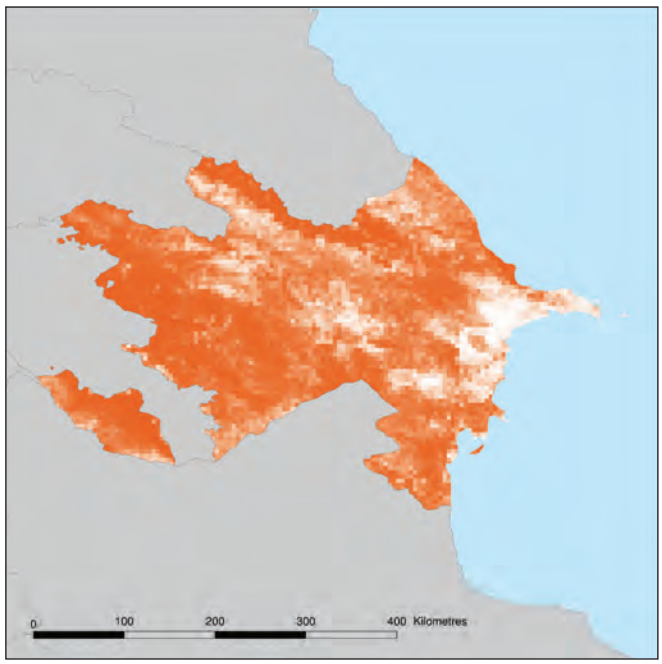
Reported Malaria Cases



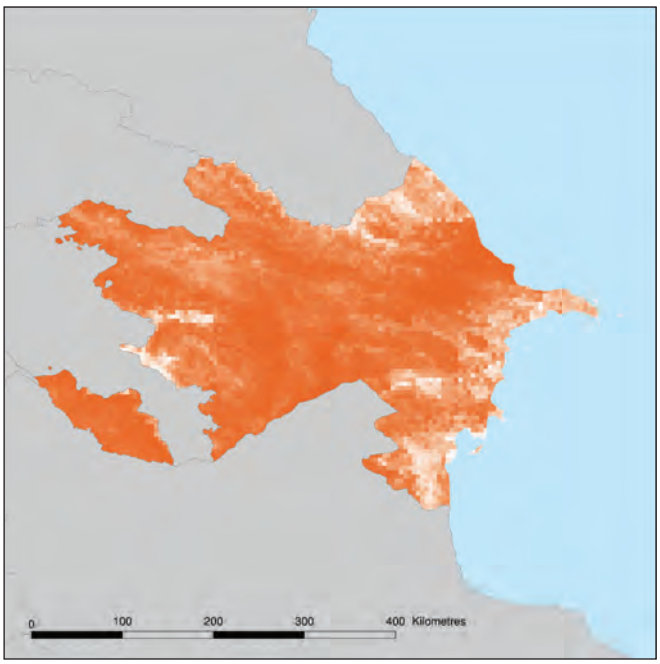
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles sacharovi*



2. *Anopheles superpictus*



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) sacharovi Favre, 1903	Variable depending on location	Small collections of sunlit fresh and brackish water with vegetation and rice fields	Both	Both	Endophilic	Dusk/ night
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available

GEORGIA

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	1
Deaths from malaria	0
Population at risk (%) (Total population: 4.4 million)	1
Annual parasite index (cases/1,000 total population/year)	0.0002
Slide positivity rate (%)	0.2

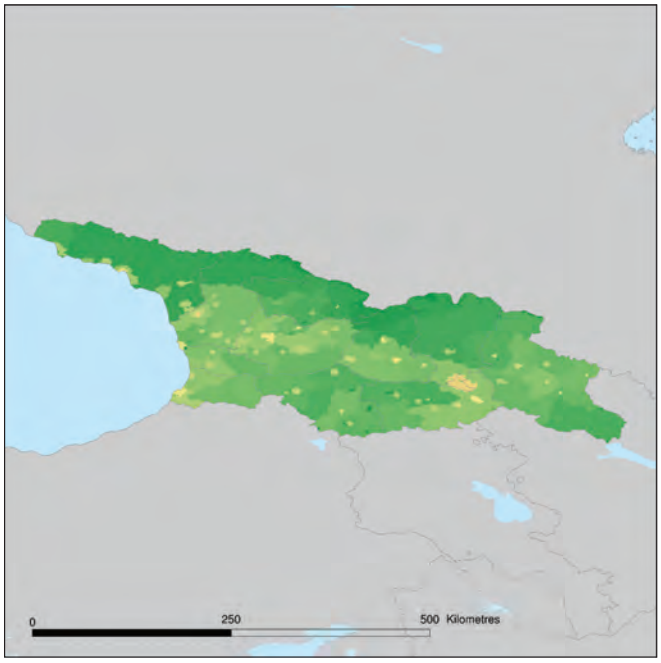
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	2,690
Country income level	Lower middle
Annual per capita health expenditure (US$)	256
Total health expenditure as % of GDP	10
Private health expenditure as % of total health expenditure	71
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

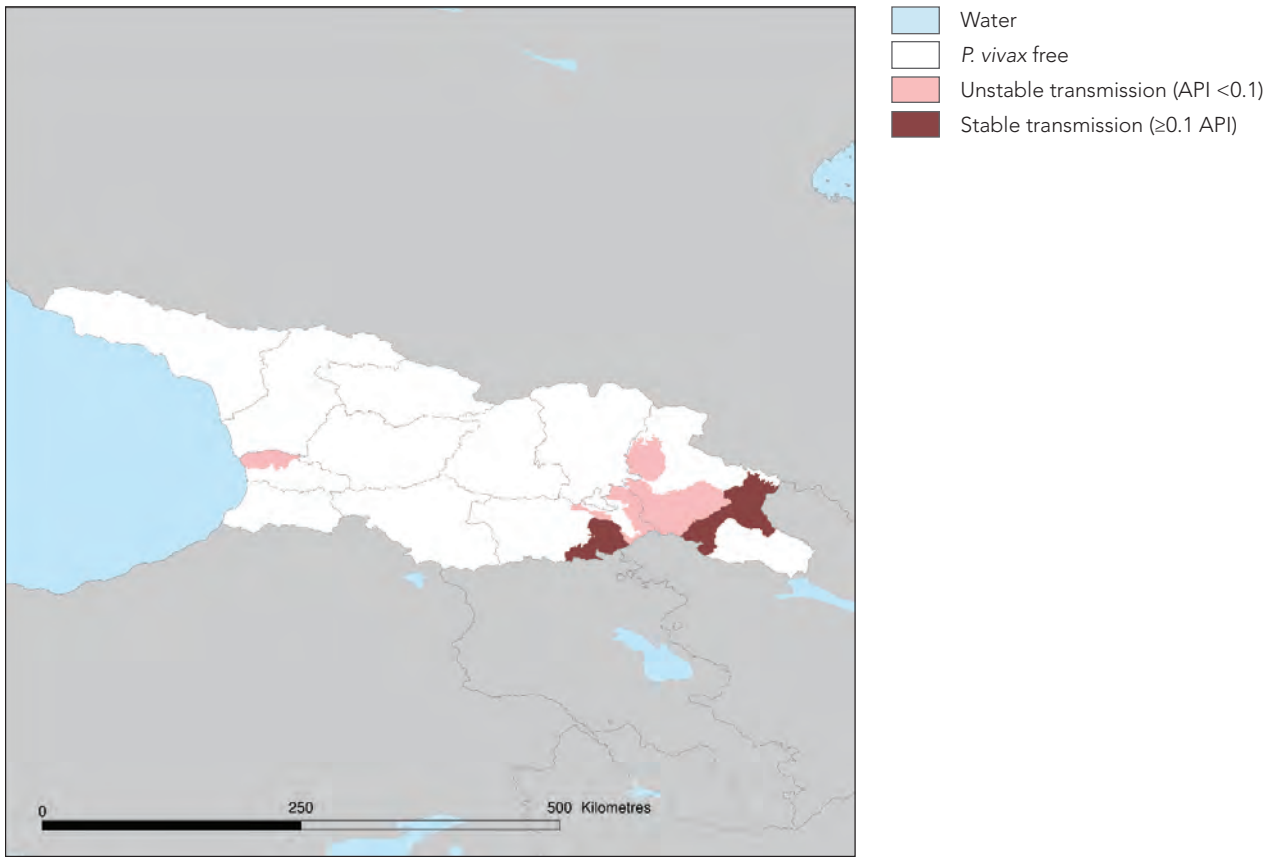
Water

Strategic Program Goal for Elimination

To eliminate *P. vivax* malaria by 2013

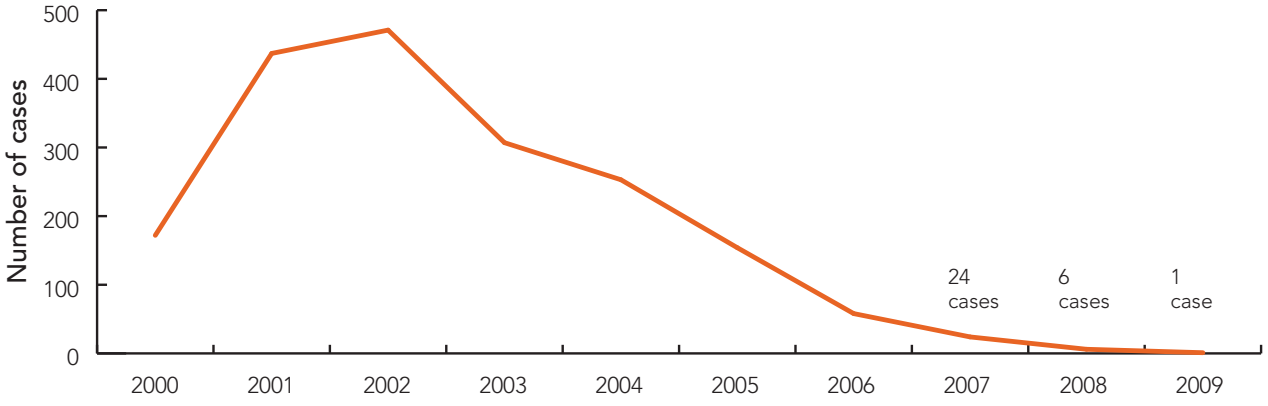
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

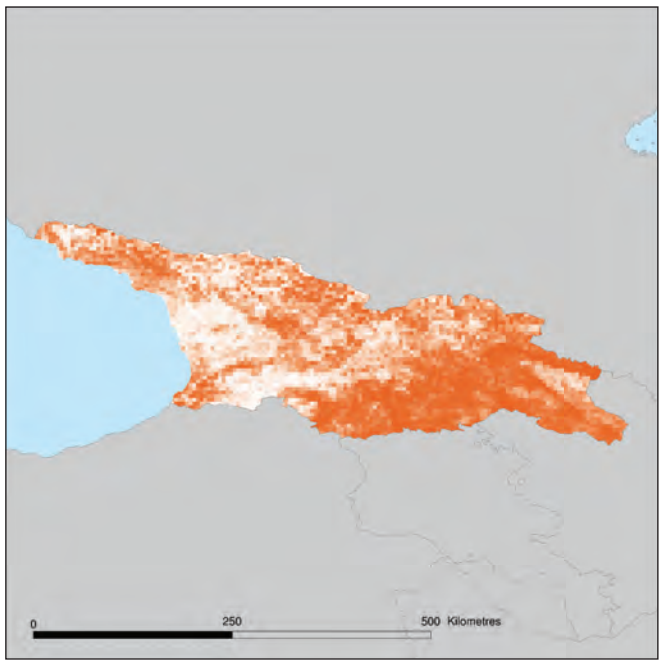
Reported Malaria Cases



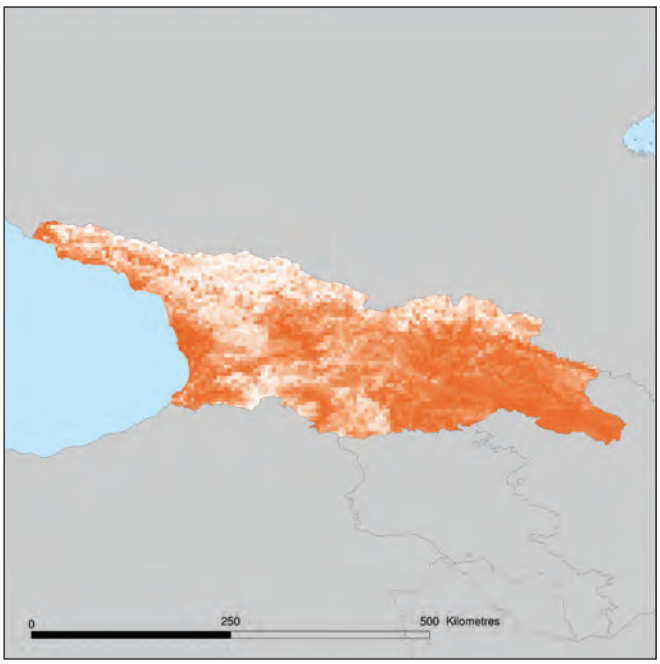
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

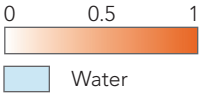
1. *Anopheles sacharovi*



2. *Anopheles superpictus*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) sacharovi Favre, 1903	Variable depending on location	Small collections of sunlit fresh and brackish water with vegetation and rice fields	Both	Both	Endophilic	Dusk/ night
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available

IRAN

Overview

Malaria at a Glance

Reported cases of malaria (90% *P. vivax*)	4,477
Deaths from malaria	N/A
Population at risk (%) (Total population: 74 million)	16
Annual parasite index (cases/1,000 total population/year)	0.06
Slide positivity rate (%)	0.6

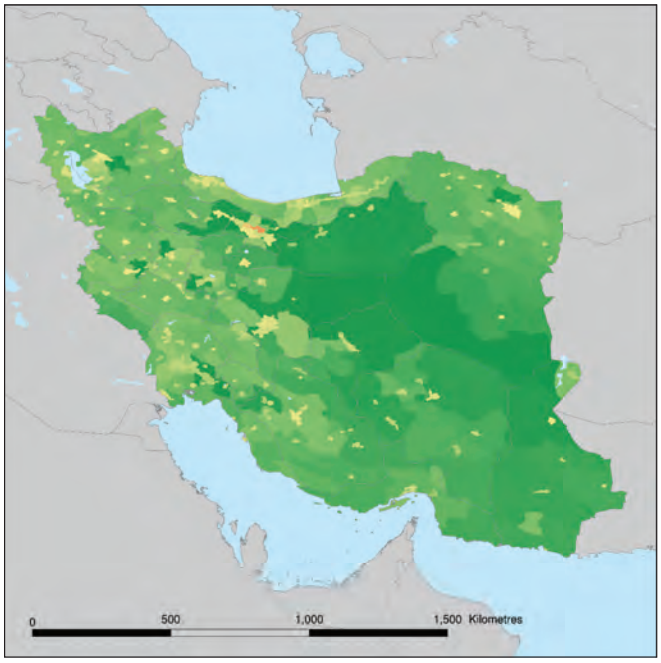
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	4,520
Country income level	Upper middle
Annual per capita health expenditure (US$)	269
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	61
Life expectancy (years)	72

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goals for Elimination

- Reduce local malaria transmission by 80% between 2006 and 2012
- Prevent malaria deaths in 20 high-risk target districts
- To eliminate local *P. falciparum* malaria in the remaining 11 malaria-affected provinces by 2016
- To reduce local *P. vivax* transmission to less than 895 cases annually by 2016

Malaria Transmission Limits

Plasmodium falciparum

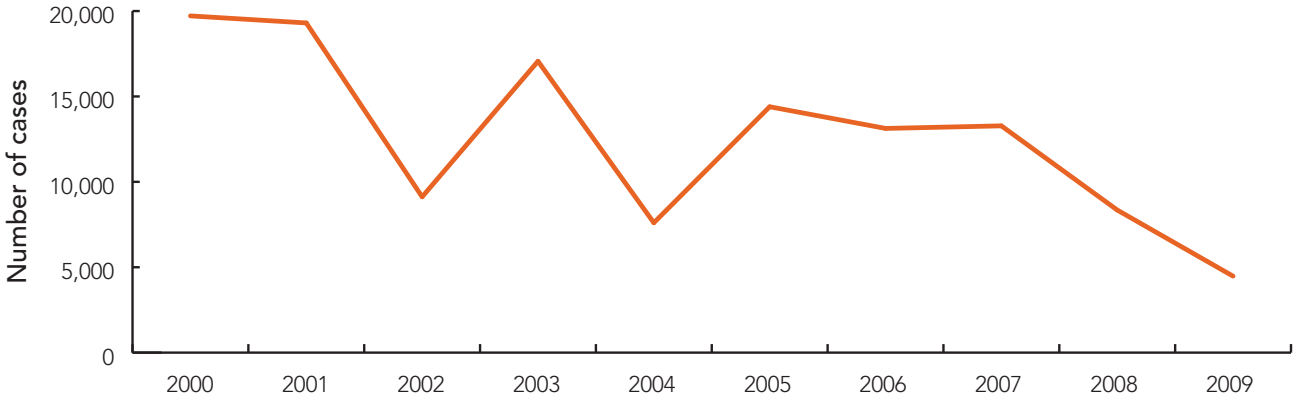
Water
P. falciparum free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

Plasmodium vivax

Water
P. vivax free
Unstable transmission (API <0.1)
Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

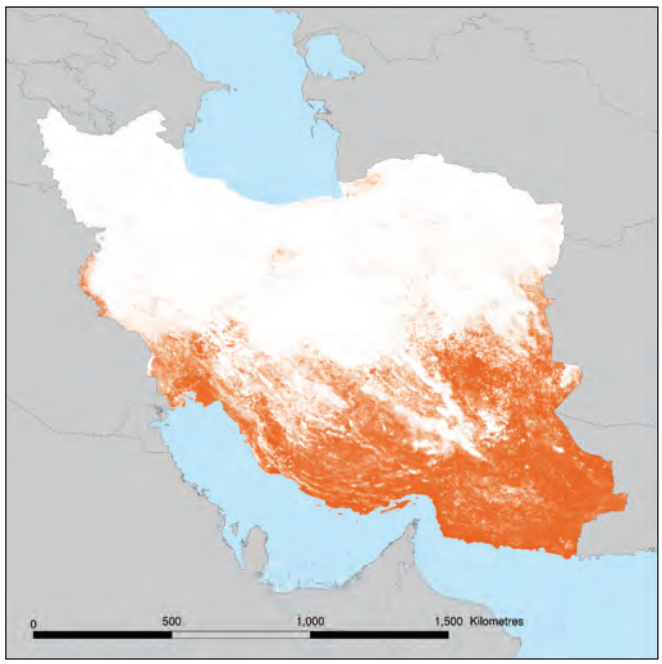
Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

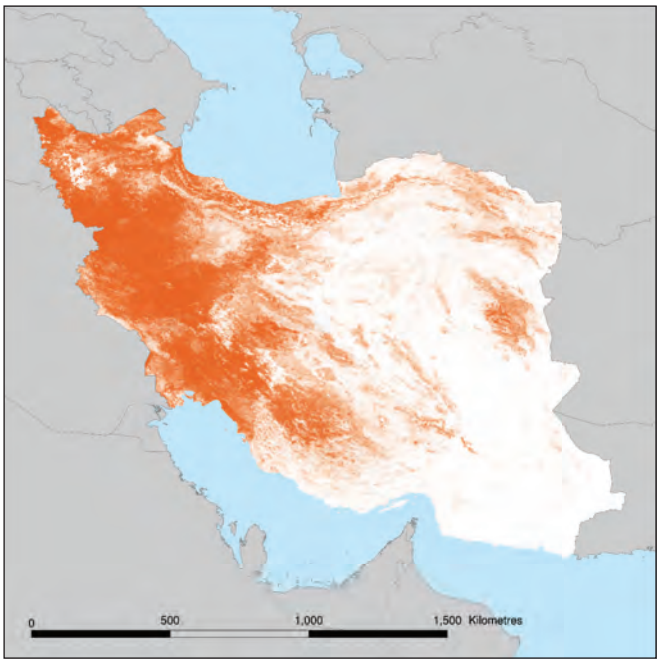
1. *Anopheles stephensi*



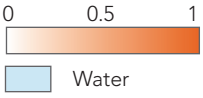
2. *Anopheles superpictus*

3. Fluviatilis Complex

4. *Anopheles sacharovi*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) stephensi Liston, 1901	Variable depending on location	Urban and peri-urban areas, rural villages	Zoophilic/both	Endophagic/ both	Endophilic	Dusk/ night
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available
Anopheles (Cellia) fluviatilis species complex	Important vector depending on species and location	Forested areas, slow-flowing streams or irrigation channels	Both	Both	Data not available	Dusk/ night
Anopheles (Anopheles) sacharovi Favre, 1903	Variable depending on location	Small collections of sunlit fresh and brackish water with vegetation and rice fields	Both	Both	Endophilic	Dusk/ night
Anopheles (Cellia) culicifacies species complex	Present but non or minor vector in Iran					

IRAQ

Overview

Malaria at a Glance

Reported cases of malaria	0
Deaths from malaria	0
Population at risk (%) (Total population: 32.3 million)	12
Annual parasite index (cases/1,000 total population/year)	0
Slide positivity rate (%)	0

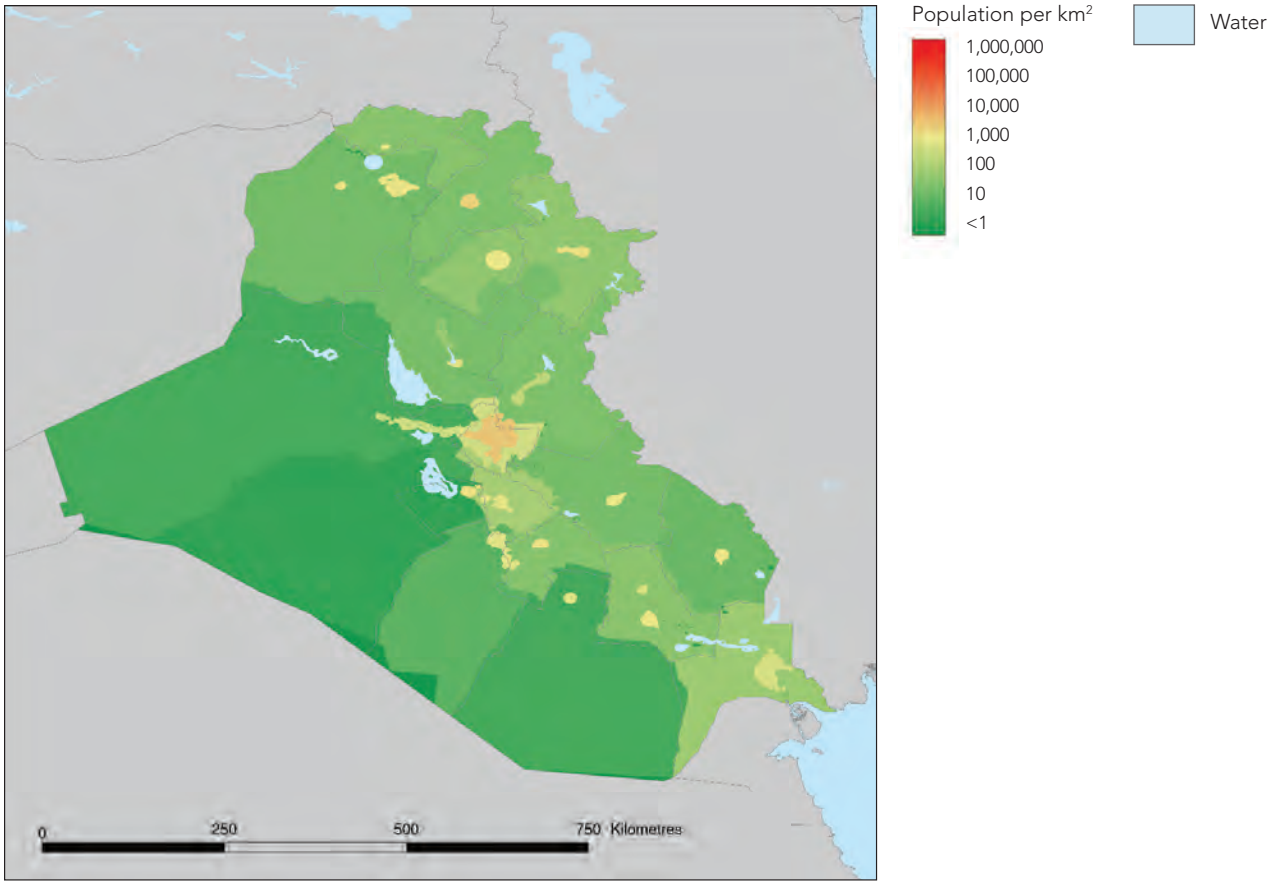
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	2,340
Country income level	Lower middle
Annual per capita health expenditure (US$)	98
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	28
Life expectancy (years)	68

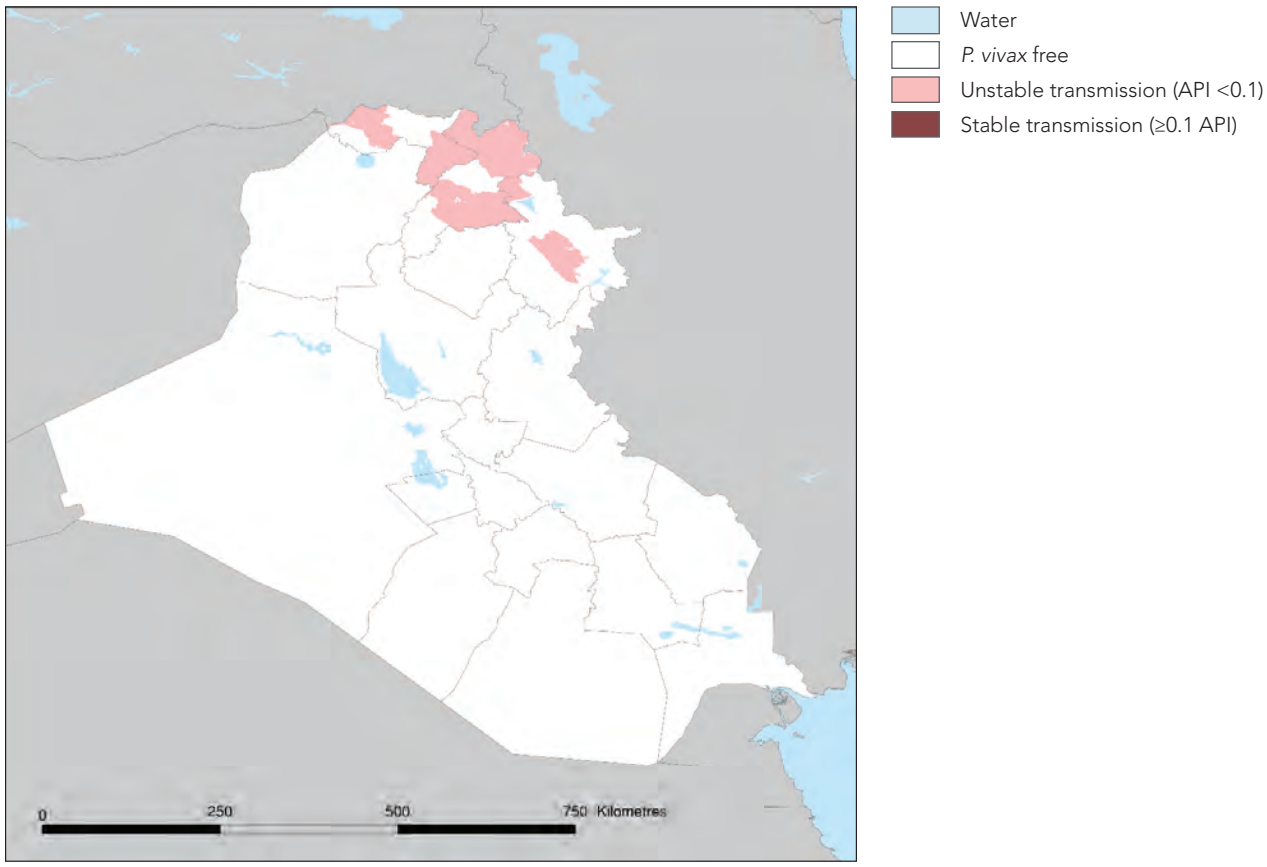
Source: World Bank, World Development Indicators

Human Population Density



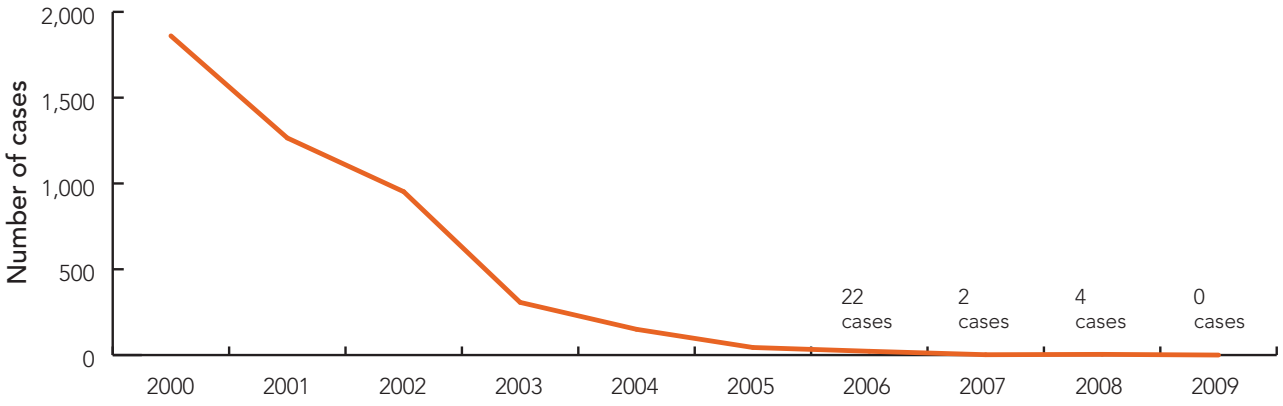
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

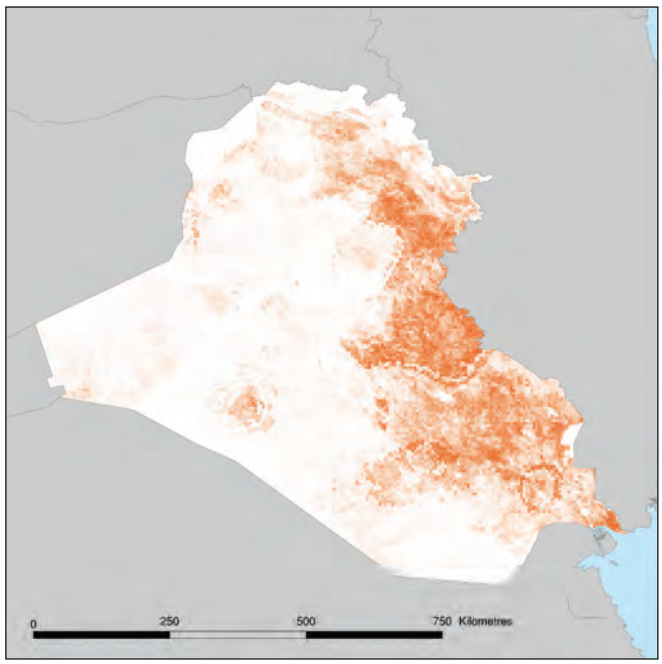
Reported Malaria Cases



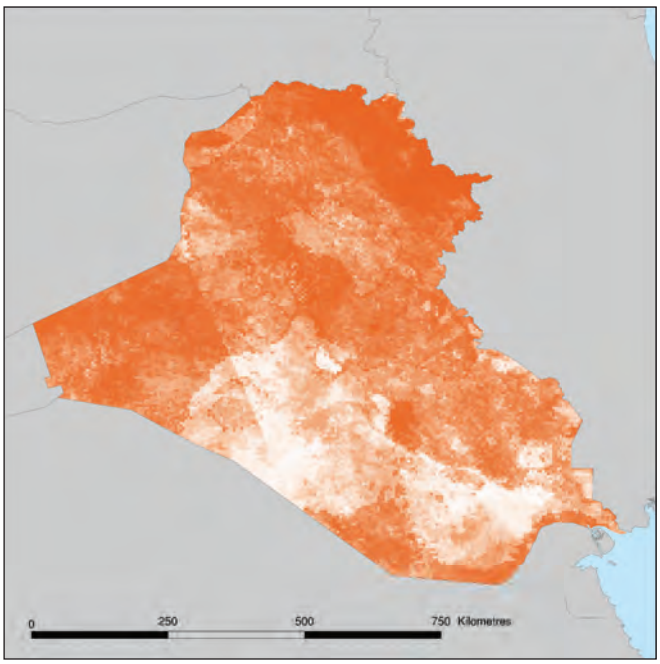
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

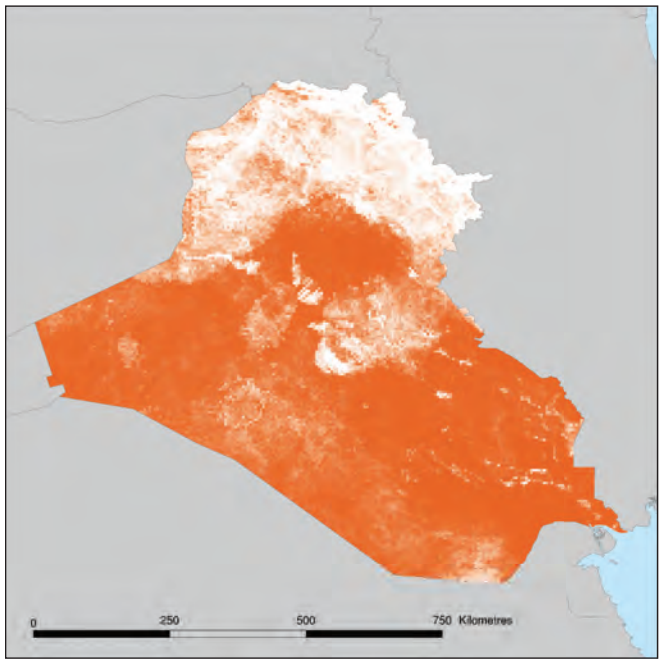
1. *Anopheles stephensi*



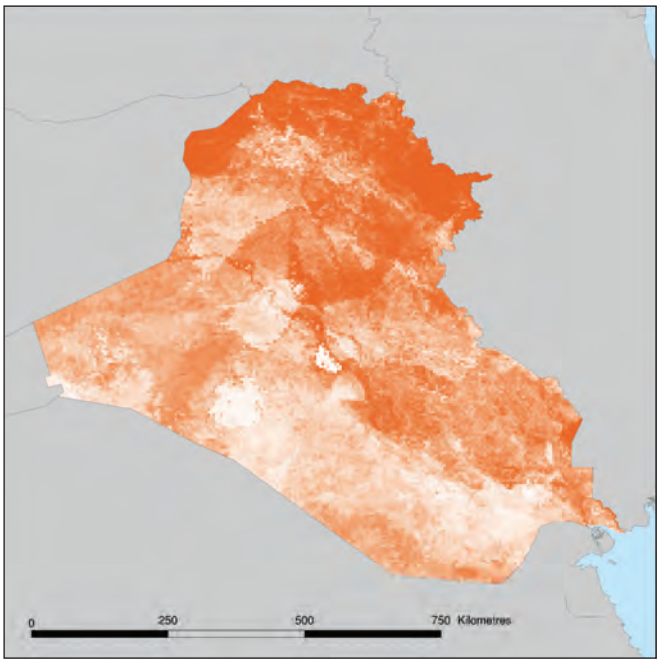
2. *Anopheles superpictus*



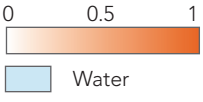
3. *Anopheles sergentii*



4. *Anopheles sacharovi*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) stephensi Liston, 1901	Important vector in urban areas around the Persian Gulf	Urban and peri-urban areas, rural villages	Zoophilic/both	Endophagic/ both	Endophilic	Dusk/ night
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available
Anopheles (Cellia) sergentii species complex	Variable depending on location	Desert oases, irrigation channels with vegetation or algae and rice fields	Both	Data not available	Both	Data not available
Anopheles (Anopheles) sacharovi Favre, 1903	Variable depending on location	Small collections of sunlit fresh and brackish water with vegetation and rice fields	Both	Both	Endophilic	Dusk/ night

KYRGYZSTAN

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	4
Deaths from malaria	0
Population at risk (%) (Total population: 5.3 million)	0.1
Annual parasite index (cases/1,000 total population/year)	0.0007
Slide positivity rate (%)	0.01

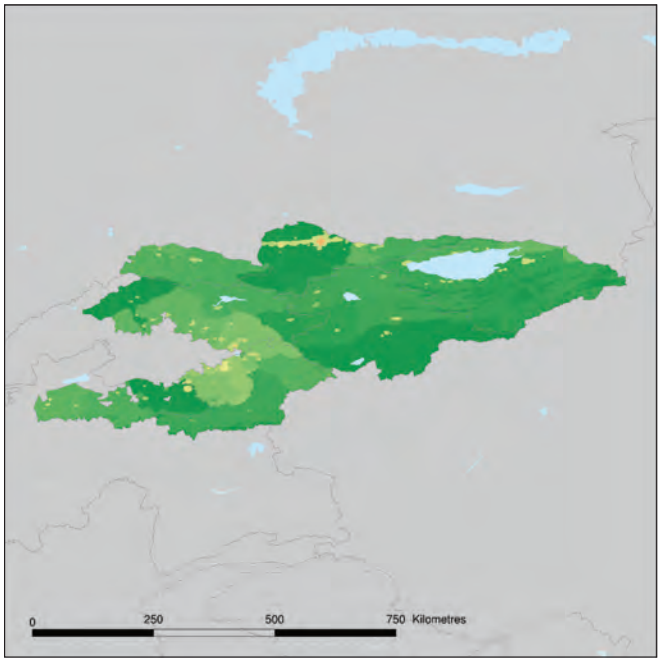
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	880
Country income level	Low
Annual per capita health expenditure (US$)	57
Total health expenditure as % of GDP	7
Private health expenditure as % of total health expenditure	49
Life expectancy (years)	69

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

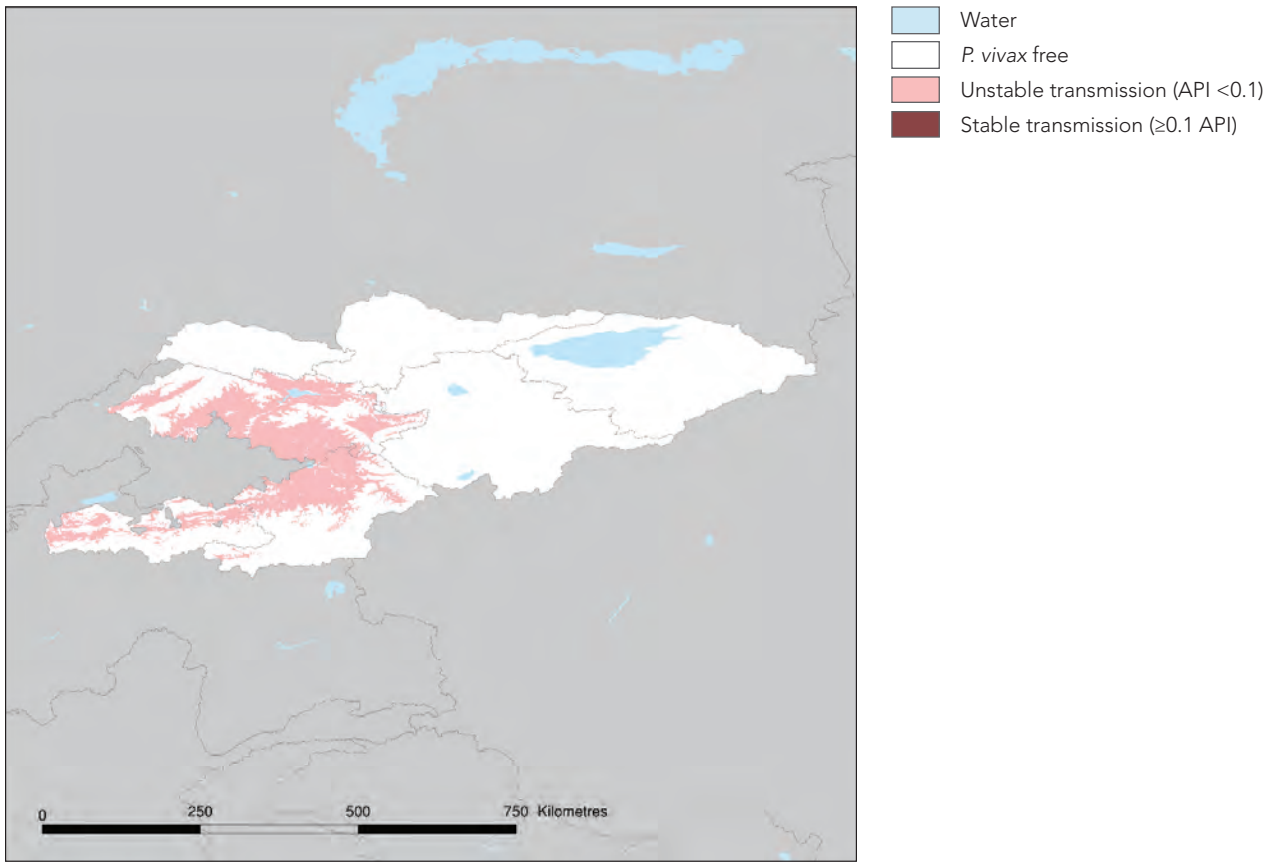
Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

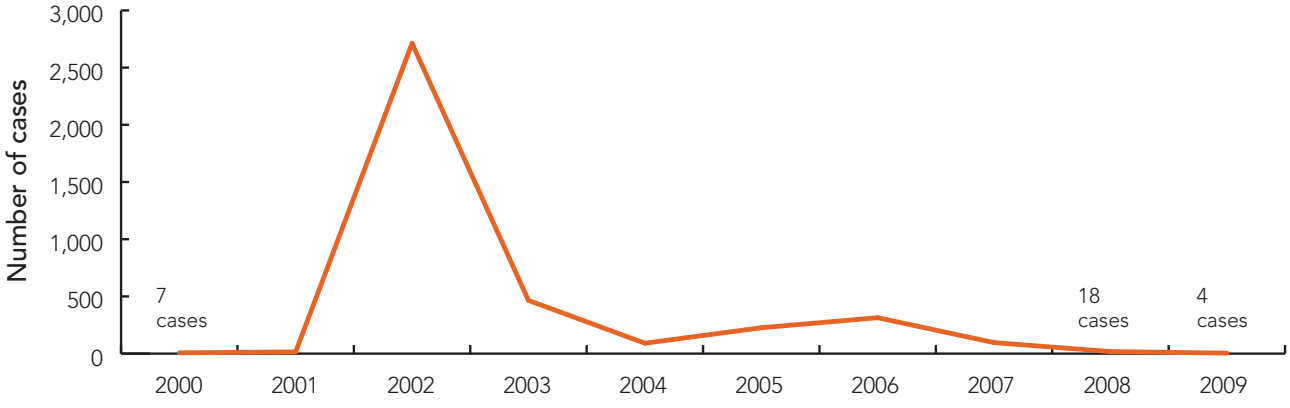
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

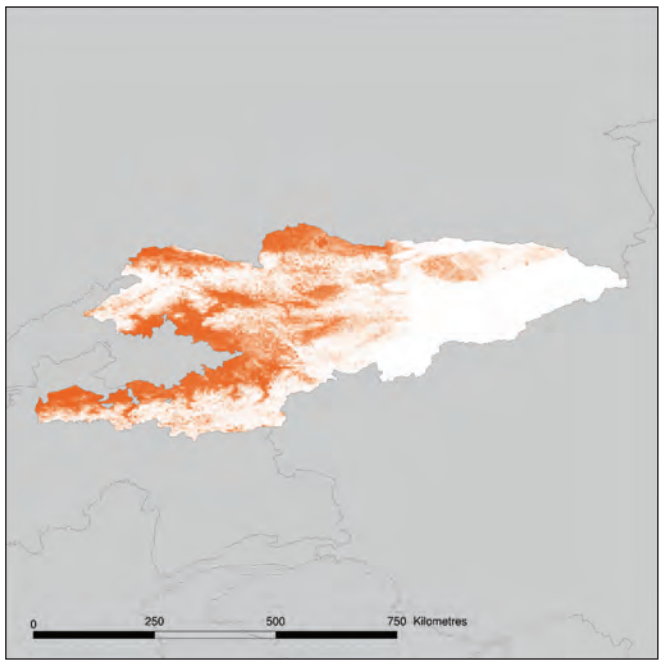
Reported Malaria Cases



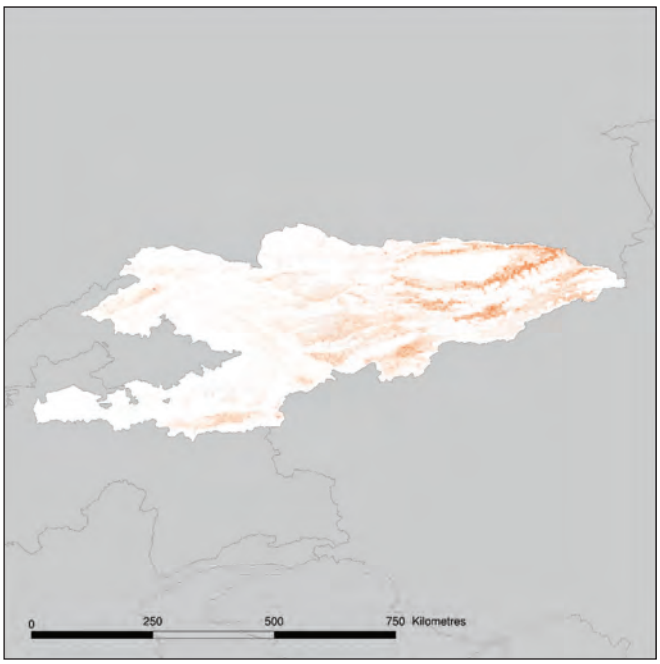
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

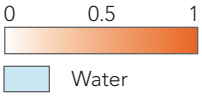
1. *Anopheles superpictus*



2. *Anopheles messeae*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available
Anopheles (Anopheles) messeae Falleroni, 1926	Variable depending on location	Shaded, clear, slow-flowing or still water	Both	Exophagic	Both	Data not available

SAUDI ARABIA

Overview

Malaria at a Glance

Reported cases of malaria (70% *P. falciparum*)	58
Deaths from malaria	0
Population at risk (%) (Total population: 27.4 million)	50
Annual parasite index (cases/1,000 total population/year)	0.002
Slide positivity rate (%)	0.005

Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	16,190
Country income level	High
Annual per capita health expenditure (US$)	714
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	33
Life expectancy (years)	74

Source: World Bank, World Development Indicators

Human Population Density

Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

Malaria Transmission Limits

Plasmodium falciparum

Data source years: 2005–06

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

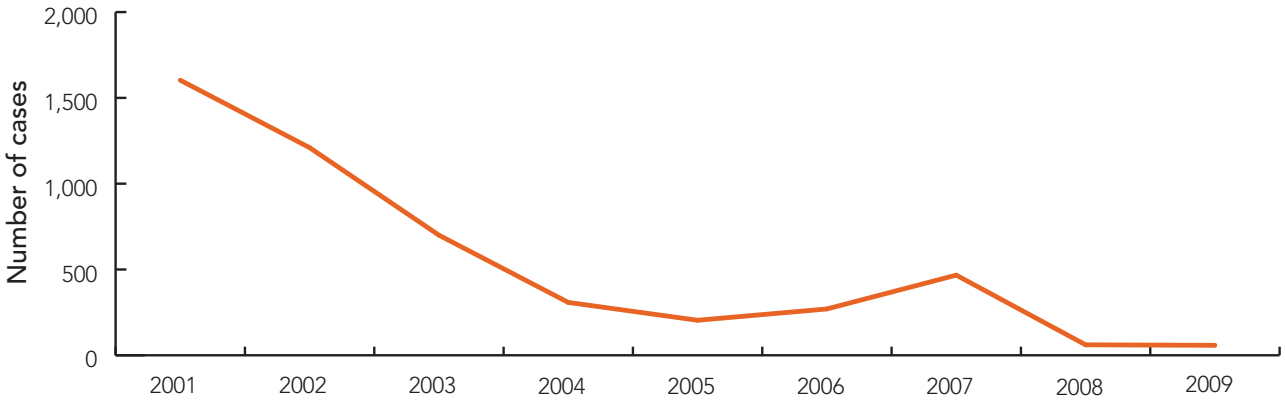
Plasmodium vivax

Data source years: 2005–06

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Low stable transmission (0.1≥ API <1.0)
- Stable transmission (≥1.0 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases



Source: WHO, World Malaria Report 2010

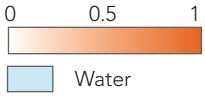
Occurrence of Malaria Vector Species

1. *Anopheles sergentii*

2. *Anopheles stephensi*

3. *Anopheles arabiensis*

Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) sergentii species complex	Variable depending on location	Desert oases, irrigation channels with vegetation or algae and rice fields	Both	Data not available	Both	Data not available
Anopheles (Cellia) stephensi Liston, 1901	Important vector in urban areas around the Persian Gulf	Urban and peri-urban areas, rural villages	Zoophilic/both	Endophagic/ both	Endophilic	Dusk/ night
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn

TAJIKISTAN

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	164
Deaths from malaria	0
Population at risk (%) (Total population: 6.8 million)	33
Annual parasite index (cases/1,000 total population/year)	0.02
Slide positivity rate (%)	0.1

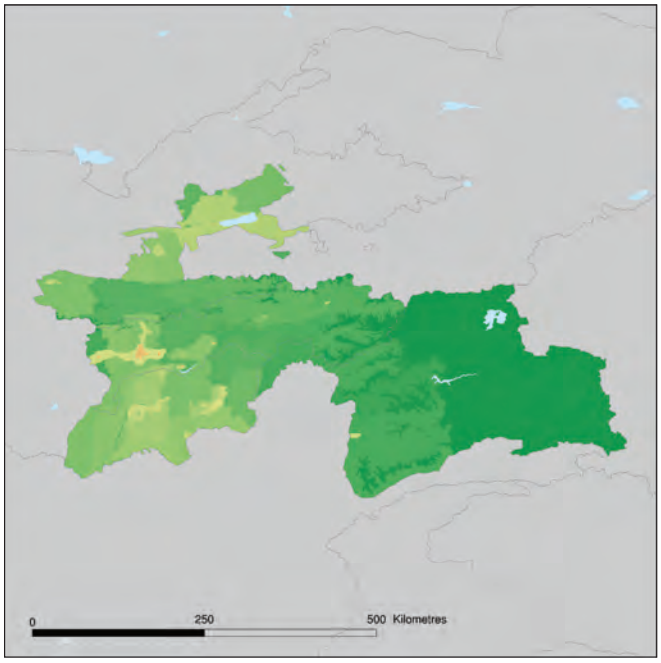
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	800
Country income level	Low
Annual per capita health expenditure (US$)	38
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	67
Life expectancy (years)	67

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

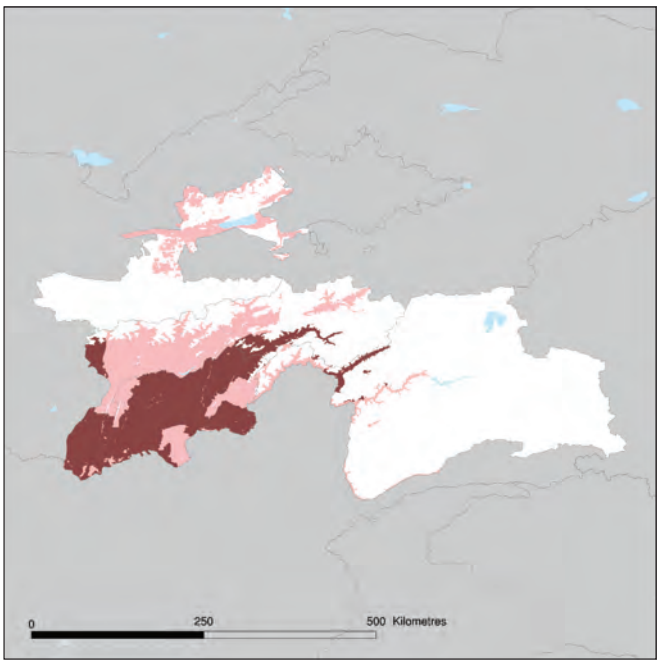
Malaria Transmission Limits

Plasmodium falciparum

No *P. falciparum* cases are reported, although *P. falciparum* transmission is possible.

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

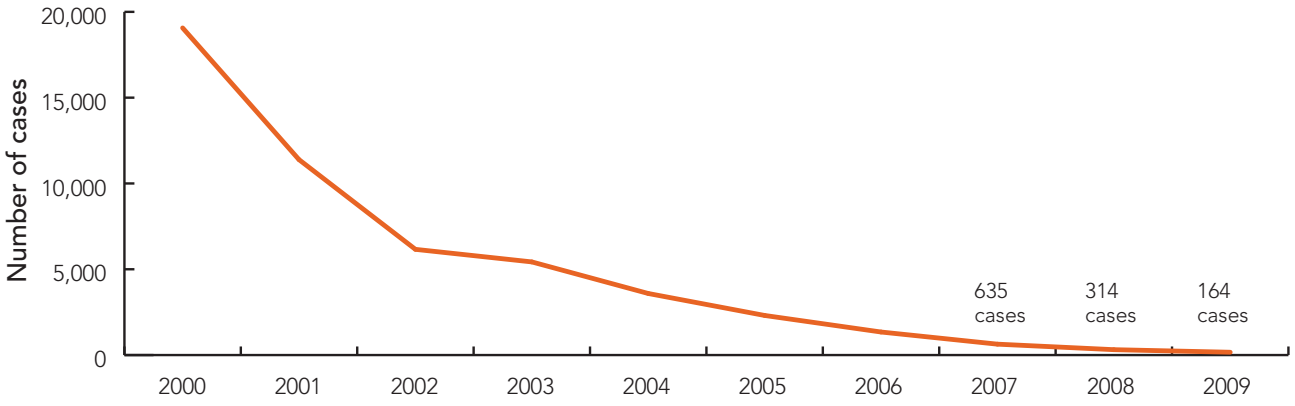
Plasmodium vivax



- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

P. falciparum/P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

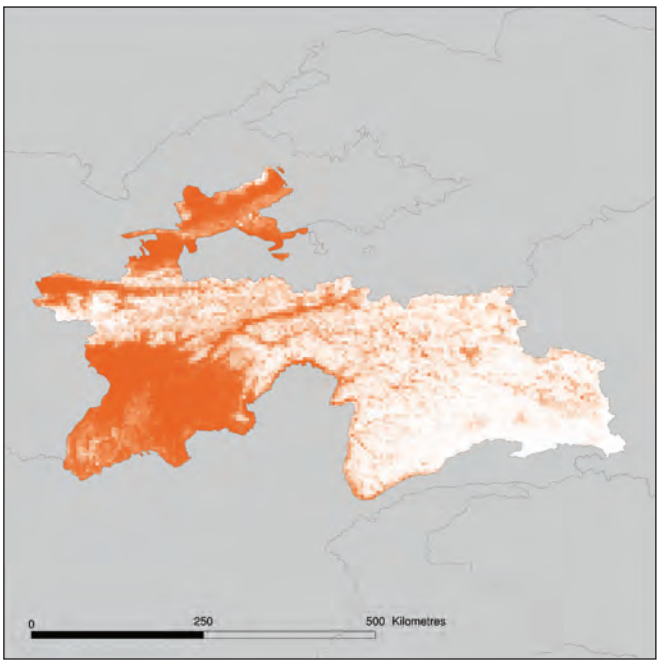
Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles superpictus*



Probability of occurrence scale

0 0.5 1

Water

This map shows the predicted probability of occurrence of this vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available

TURKEY

Overview

Malaria at a Glance

Reported cases of malaria (*P. vivax* only)	38
Deaths from malaria	1
Population at risk (%) (Total population: 72.7 million)	0.02
Annual parasite index (cases/1,000 total population/year)	0.0005
Slide positivity rate (%)	0.006

Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	9,890
Country income level	Upper middle
Annual per capita health expenditure (US$)	571
Total health expenditure as % of GDP	7
Private health expenditure as % of total health expenditure	25
Life expectancy (years)	73

Source: World Bank, World Development Indicators

Human Population Density

Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goal for Elimination

To interrupt malaria transmission by 2012 and eliminate the disease by 2015

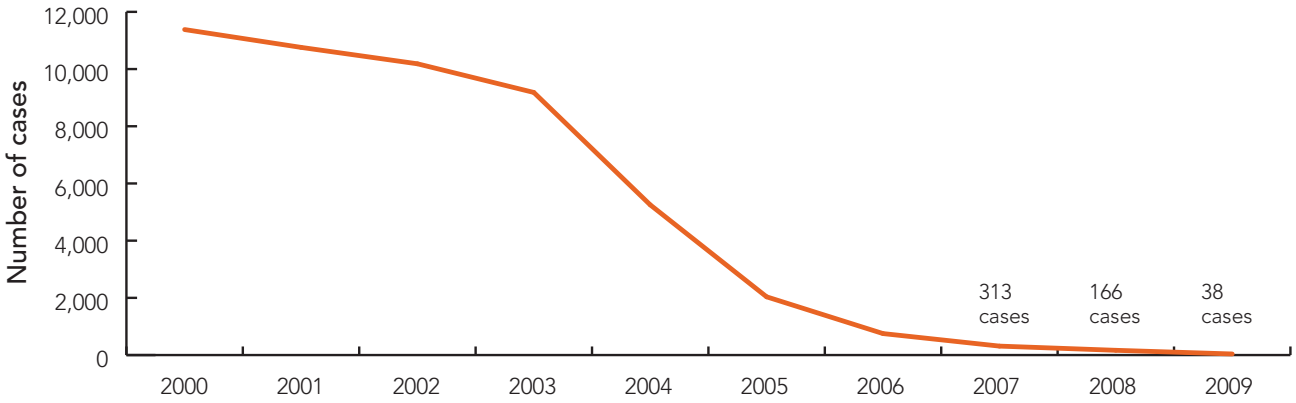
Malaria Transmission Limits

Plasmodium vivax

Water
P. vivax free
Unstable transmission (API <0.1)
Low stable transmission (0.1≥ API <1.0)
Stable transmission (≥1.0 API)

P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), low stable risk of ≥0.1 to <1.0 case per 1,000 population (API), and stable risk of ≥1.0 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles sacharovi*

2. *Anopheles superpictus*

3. *Anopheles messeae*

Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Anopheles) sacharovi Favre, 1903	Variable depending on location	Small collections of sunlit fresh and brackish water with vegetation and rice fields	Both	Both	Endophilic	Dusk/ night
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available
Anopheles (Anopheles) messeae Falleroni, 1926	Present but non or minor vector in Turkey					

UZBEKISTAN

Overview

Malaria at a Glance

Reported cases of malaria	0
Deaths from malaria	0
Population at risk (%) (Total population: 28.2 million)	0
Annual parasite index (cases/1,000 total population/year)	0
Slide positivity rate (%)	0

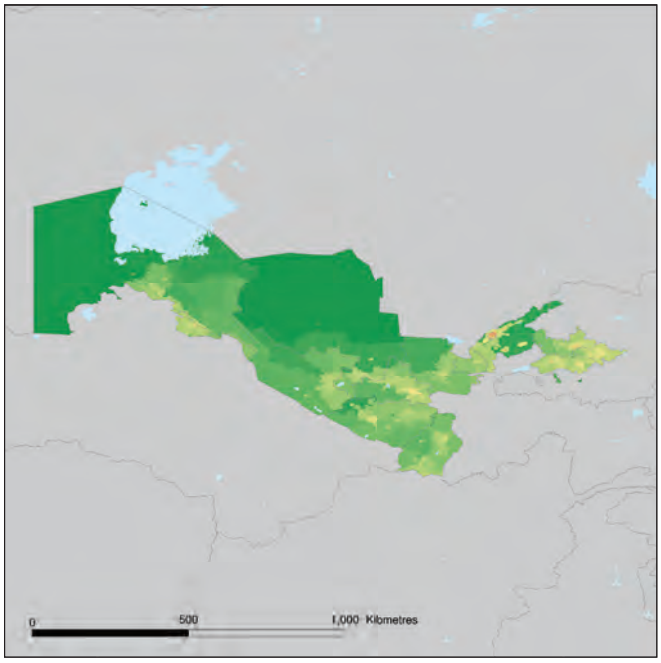
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,280
Country income level	Lower middle
Annual per capita health expenditure (US$)	62
Total health expenditure as % of GDP	5
Private health expenditure as % of total health expenditure	53
Life expectancy (years)	68

Source: World Bank, World Development Indicators

Human Population Density



Population per km²

1,000,000
100,000
10,000
1,000
100
10
<1

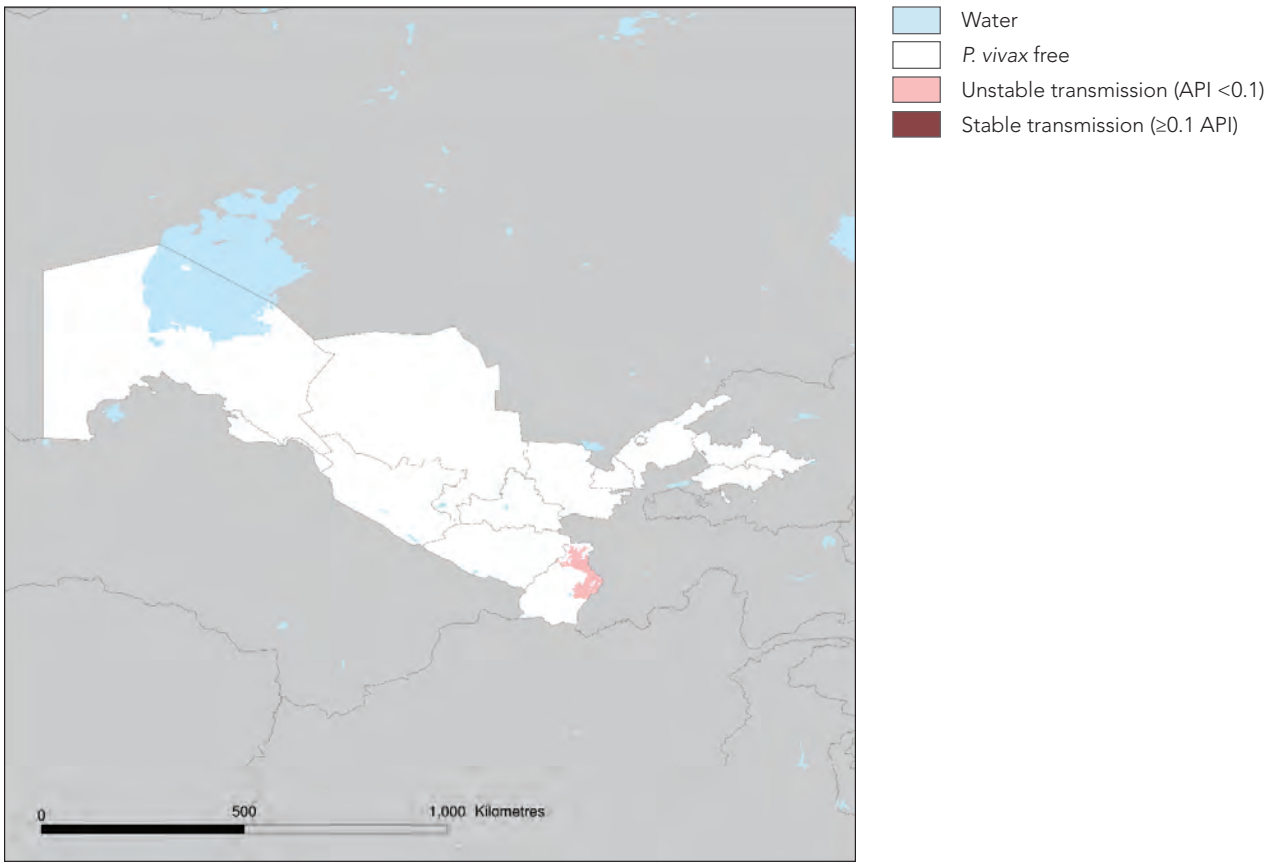
Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

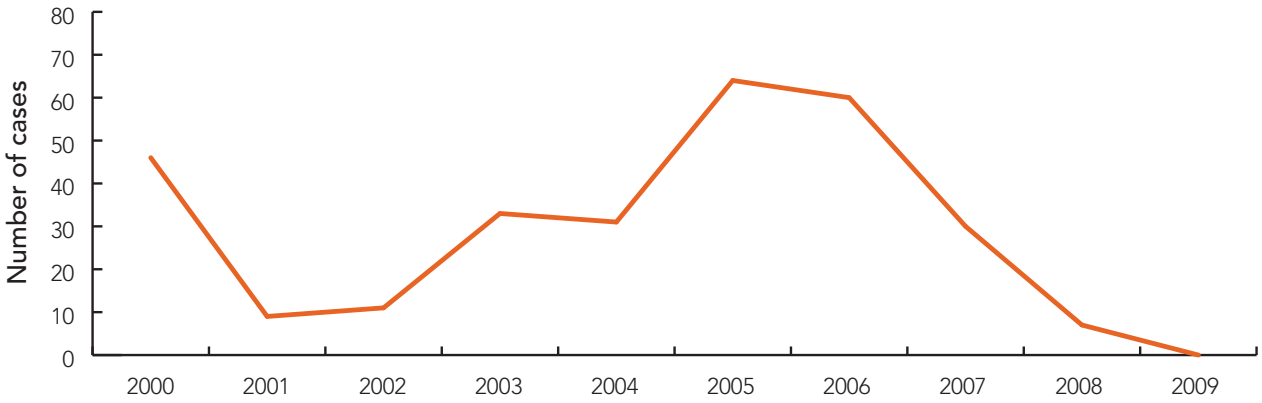
Malaria Transmission Limits

Plasmodium vivax



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

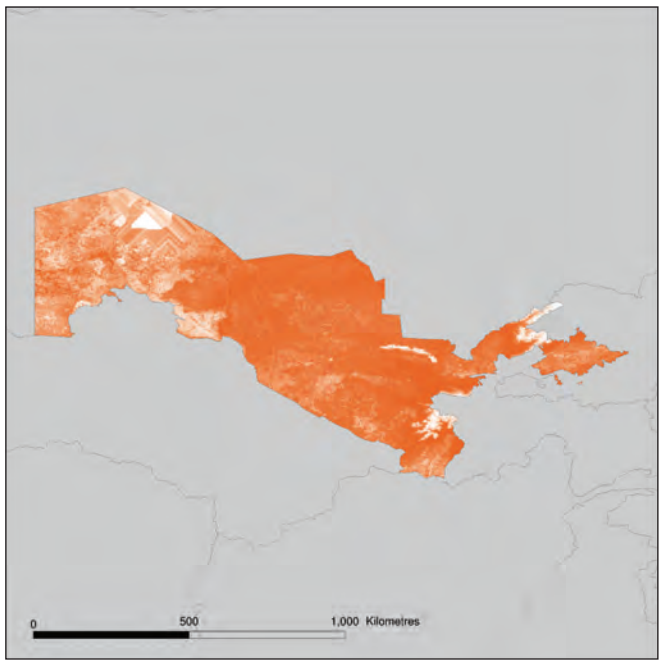
Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

1. *Anopheles superpictus*



2. *Anopheles messeae*

Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

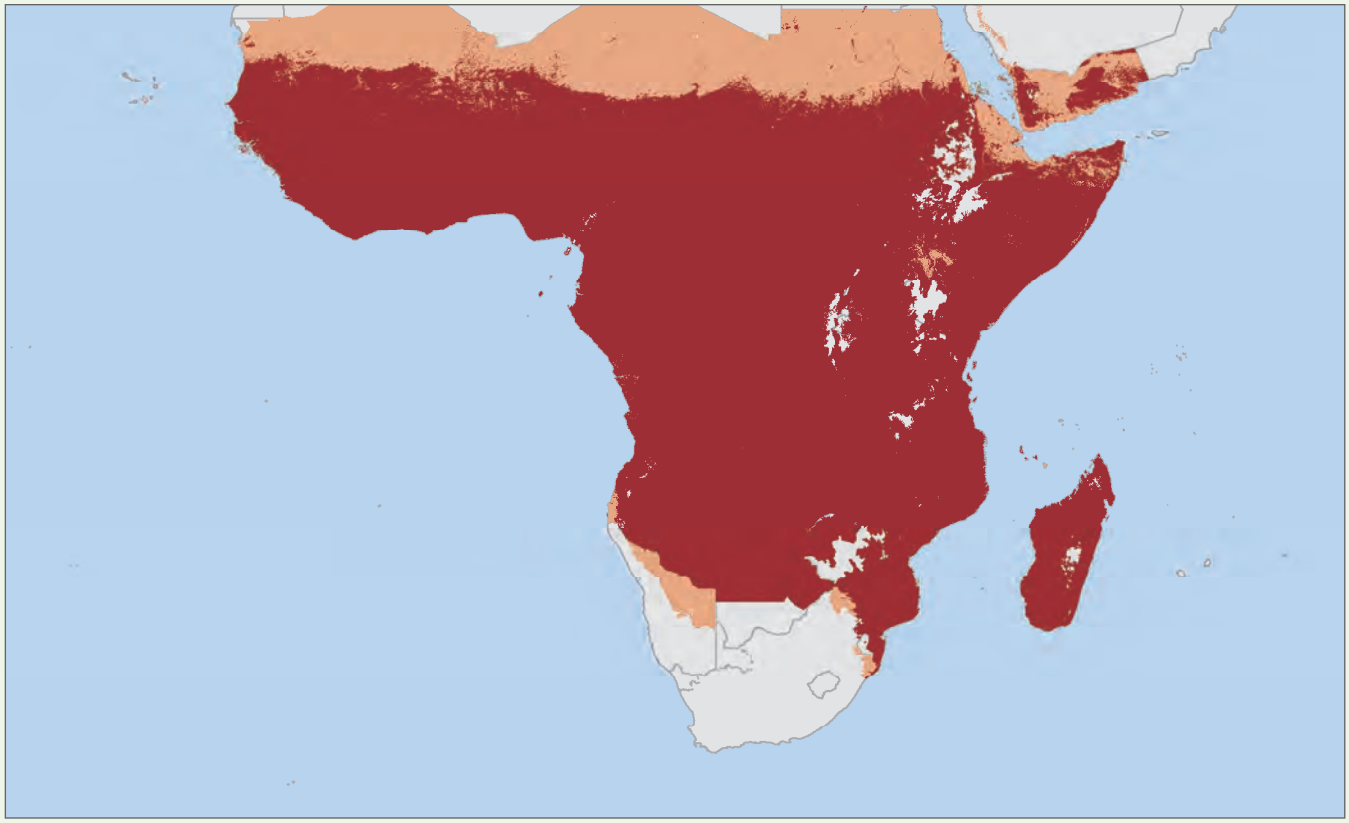
Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) superpictus Grassi, 1899	Variable depending on location	Gravel stream beds, irrigation channels and rice fields, including high altitudes	Both	Exophagic/ both	Both	Data not available
Anopheles (Anopheles) messeae Falleroni, 1926	Variable depending on location	Shaded, clear, slow-flowing or still water	Both	Exophagic	Both	Data not available

Sub-Saharan Africa

Botswana | Cape Verde | Namibia | São Tomé and Príncipe
South Africa | Swaziland

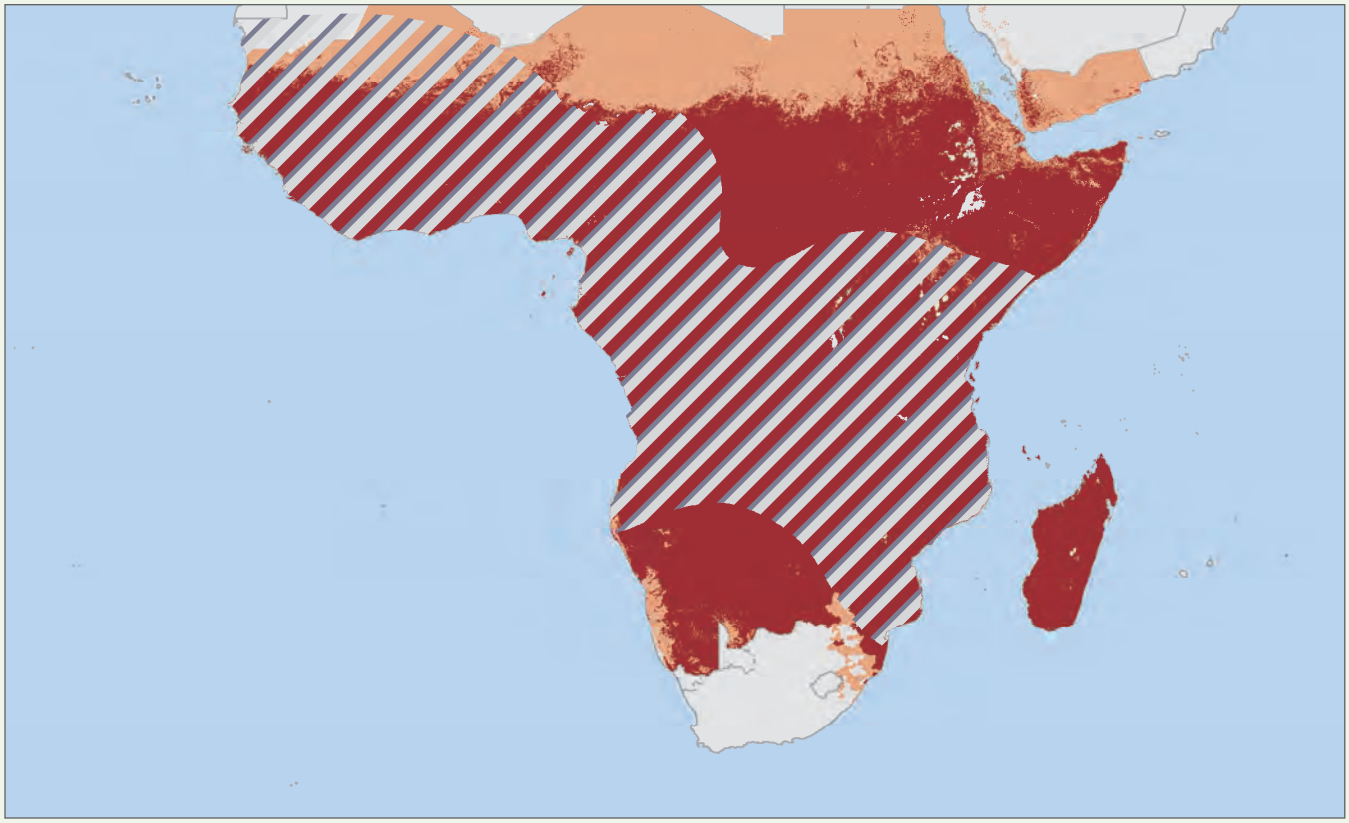
Malaria Transmission Limits for *Plasmodium falciparum*



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

- Water
- *P. falciparum* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)

Malaria Transmission Limits for *Plasmodium vivax*



P. vivax malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas. Areas where Duffy negative prevalence was estimated as ≥90% are hatched, indicating where the populations at risk are modulated most significantly by the presence of this genetic trait.

- Water
- *P. vivax* free
- Unstable transmission (API <0.1)
- Stable transmission (≥0.1 API)
- Duffy negativity ≥90%

BOTSWANA

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	14,878
Deaths from malaria	6
Population at risk (%) (Total population: 2 million)	63
Annual parasite index (cases/1,000 total population/year)	7
Slide positivity rate (%)	N/A

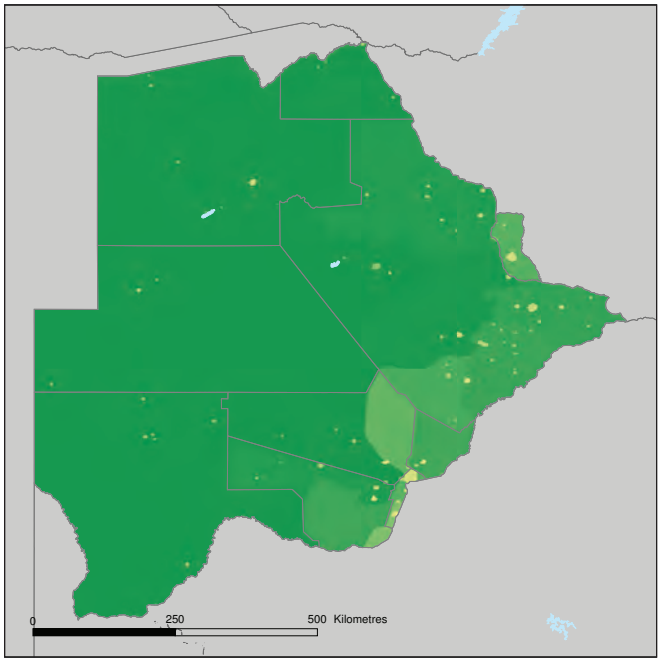
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	6,890
Country income level	Upper middle
Annual per capita health expenditure (US$)	612
Total health expenditure as % of GDP	10
Private health expenditure as % of total health expenditure	20
Life expectancy (years)	55

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

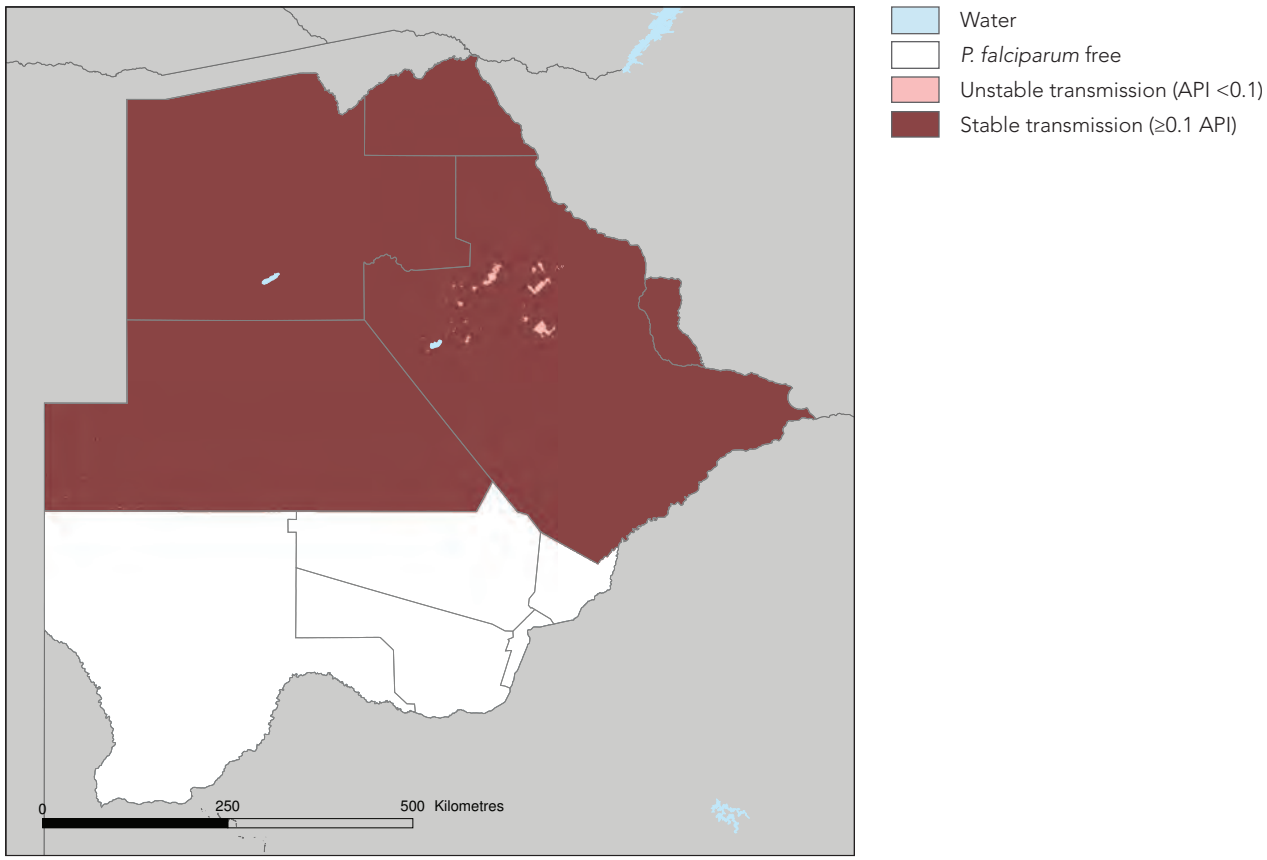
Water

Strategic Program Goal for Elimination

To achieve zero local malaria transmission by 2015

Malaria Transmission Limits

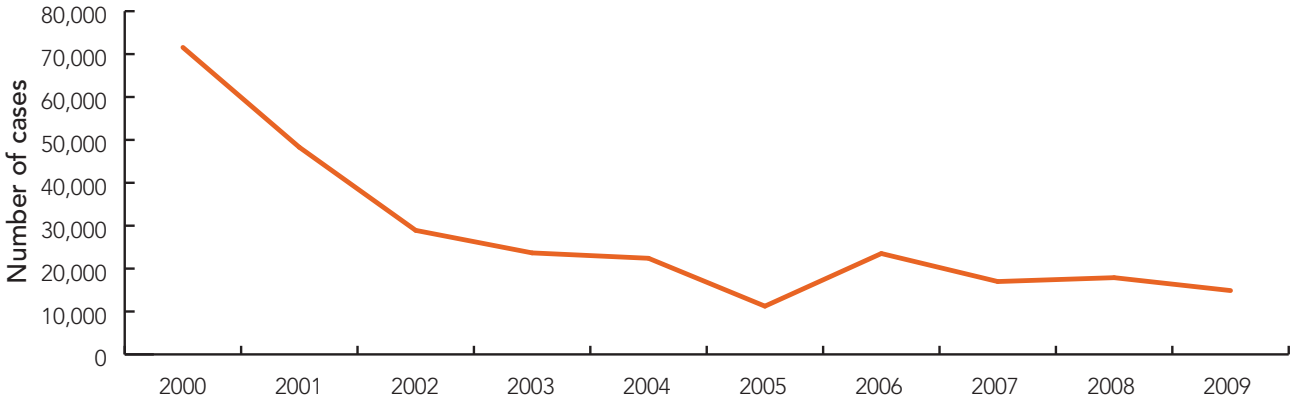
Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

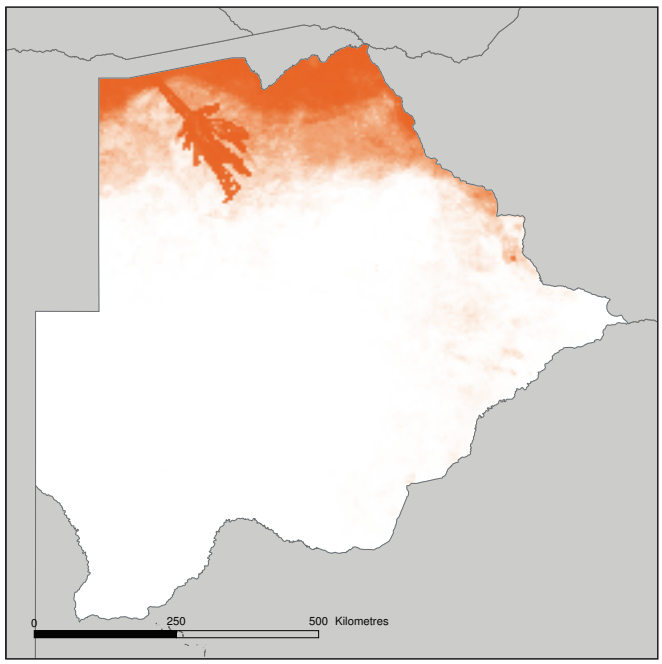
Reported Malaria Cases



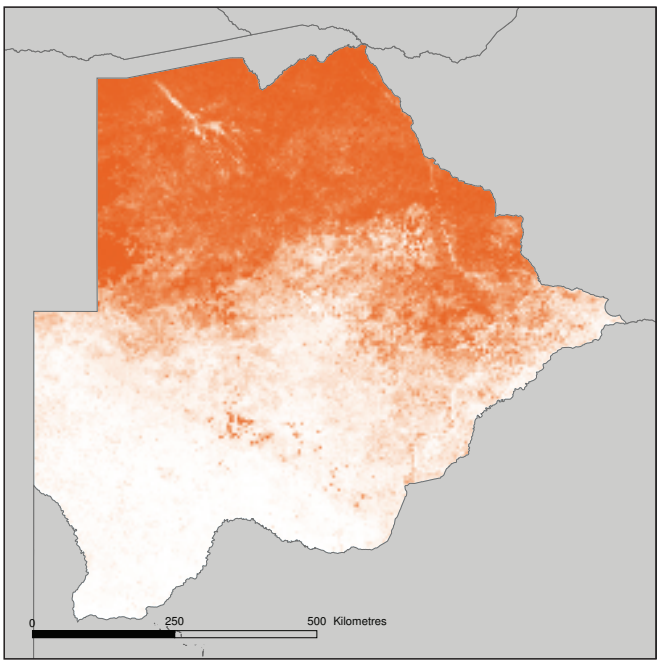
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

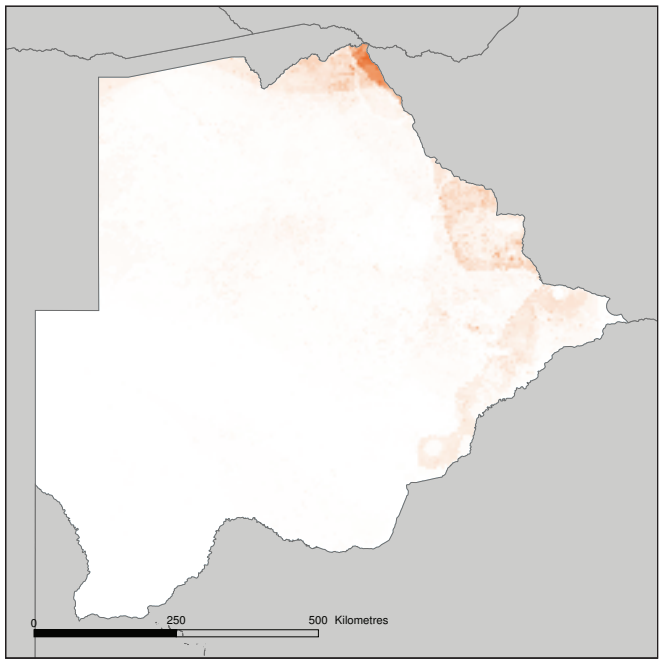
1. *Anopheles funestus*



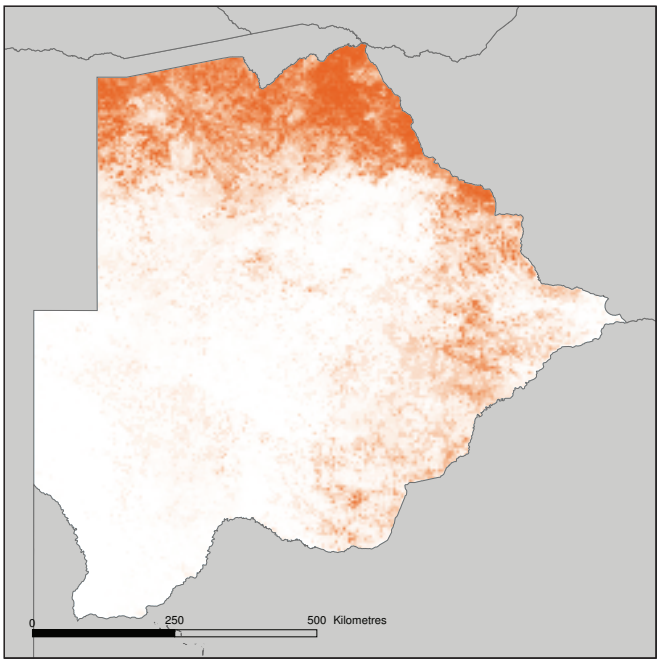
2. *Anopheles arabiensis*



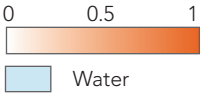
3. *Anopheles gambiae*



4. Nili Complex



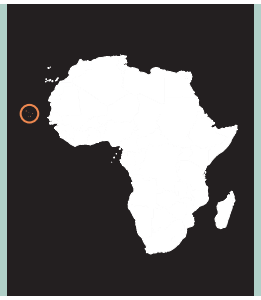
Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) funestus Giles, 1900	Important vector wherever found	Swamps, lakes edges with emergent vegetation and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) gambiae Giles, 1902	Highly competent vector	Sunlit shallow temporary pools and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) nili species complex	Malaria vector throughout range	Edges of fast-flowing streams and rivers, in degraded forest and savannah	Both	Both	Both	Dusk/ night



CAPE VERDE

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	65
Deaths from malaria	2
Population at risk (%) (Total population: 512,582)	25
Annual parasite index (cases/1,000 total population/year)	0.1
Slide positivity rate (%)	0.3

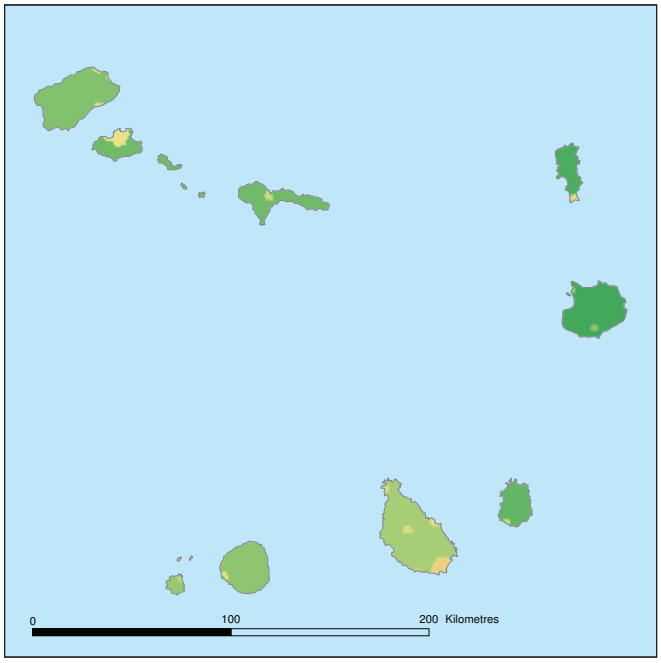
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	3,160
Country income level	Lower middle
Annual per capita health expenditure (US$)	146
Total health expenditure as % of GDP	4
Private health expenditure as % of total health expenditure	26
Life expectancy (years)	71

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

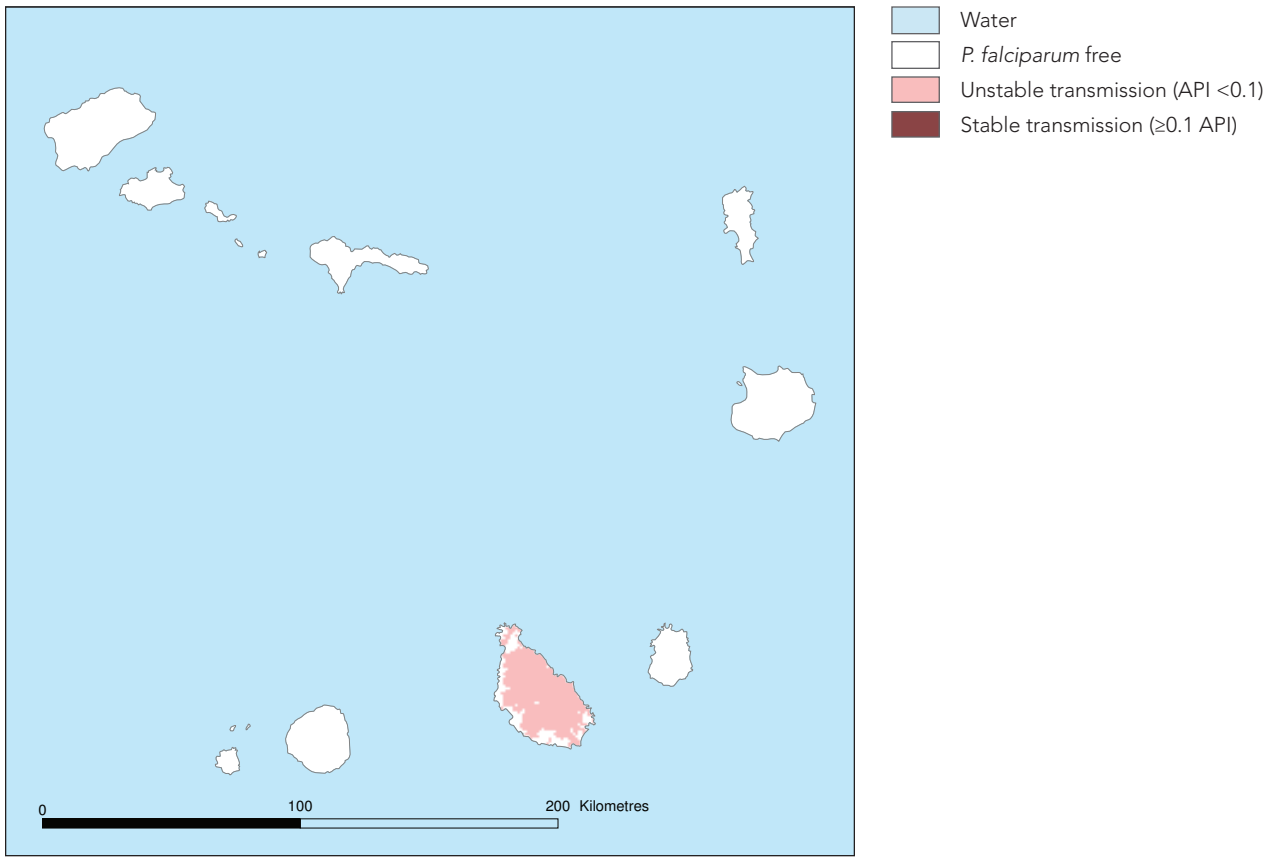
Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

Malaria Transmission Limits

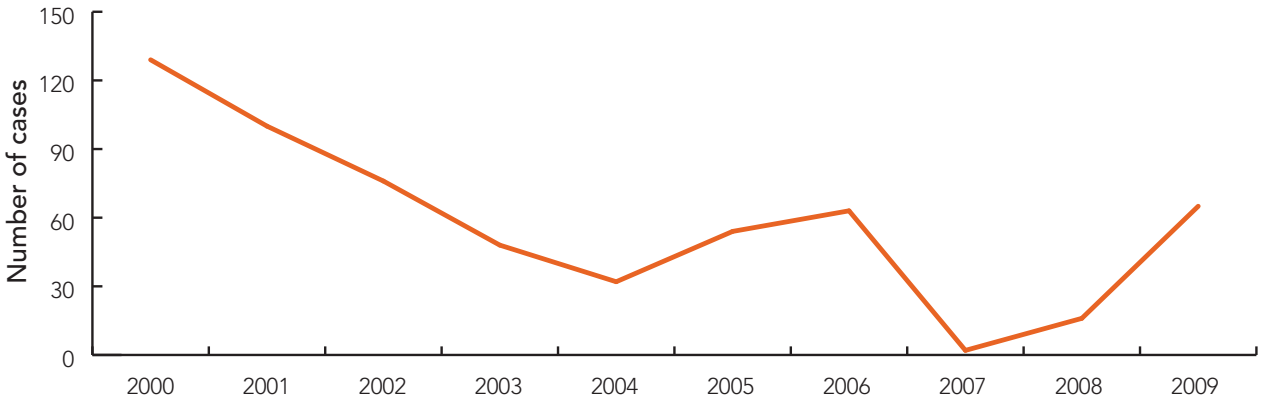
Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

Reported Malaria Cases



Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

There are currently no malaria vector maps available for Cape Verde, however we hope to develop these over the coming years.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn

NAMIBIA

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	81,812
Deaths from malaria	46
Population at risk (%) (Total population: 2.2 million)	70
Annual parasite index (cases/1,000 total population/year)	37
Slide positivity rate (%)	N/A

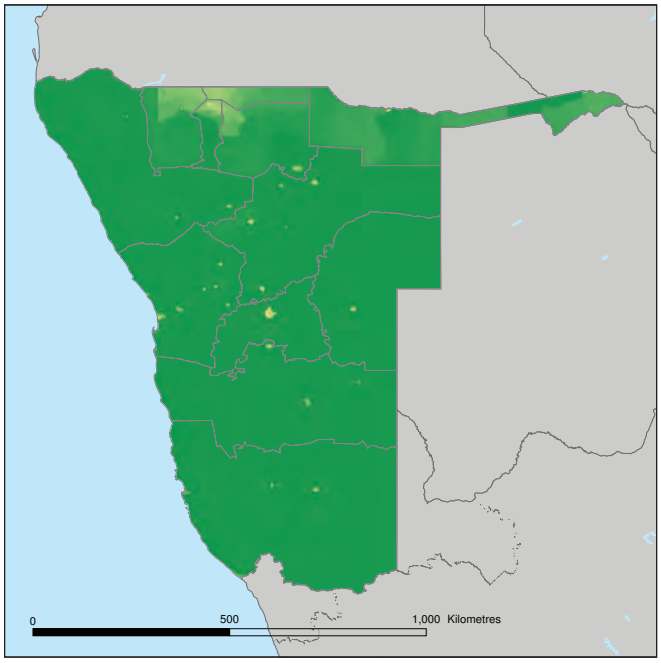
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	4,650
Country income level	Upper middle
Annual per capita health expenditure (US$)	258
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	34
Life expectancy (years)	62

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

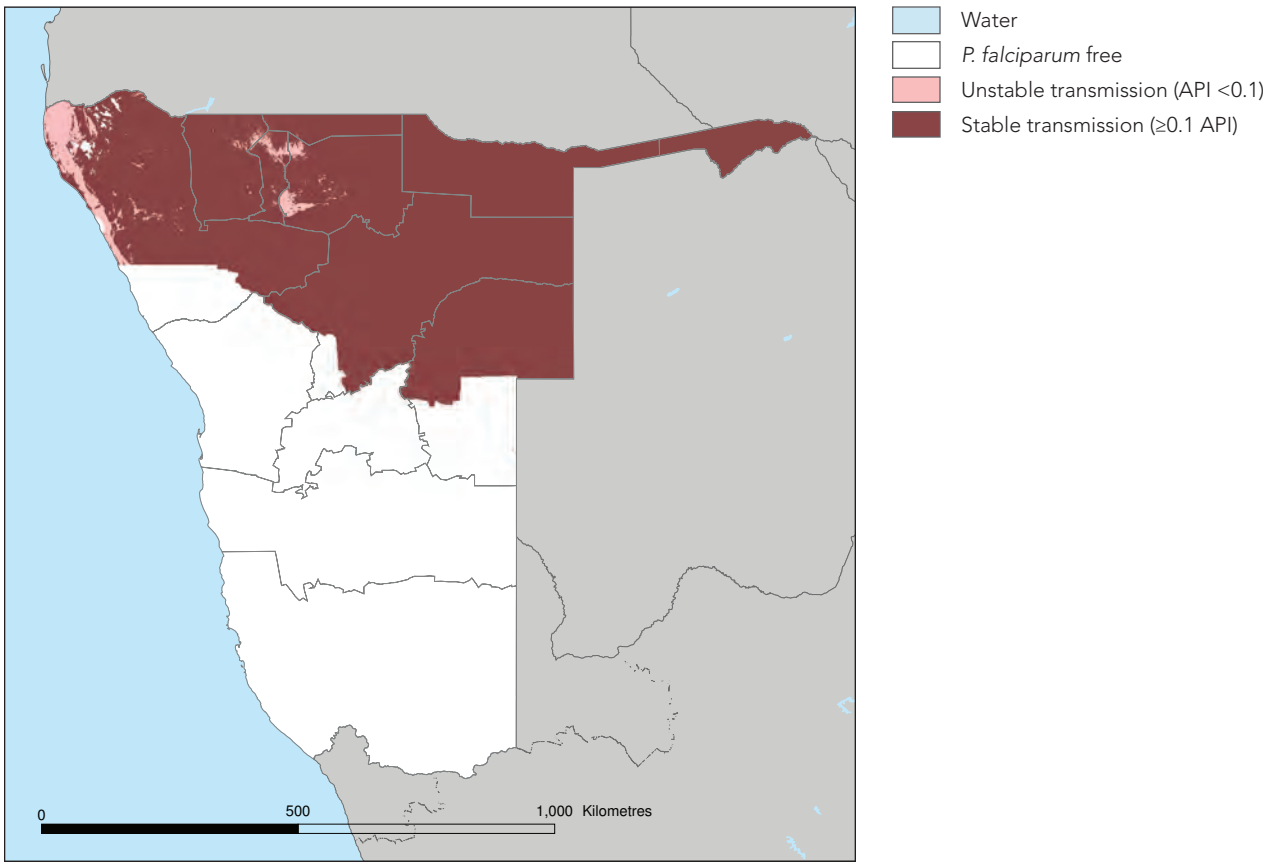
Water

Strategic Program Goals for Elimination

- Reduce the incidence of malaria to below 1 per 1,000 population in every district by 2016
- National malaria elimination by 2020

Malaria Transmission Limits

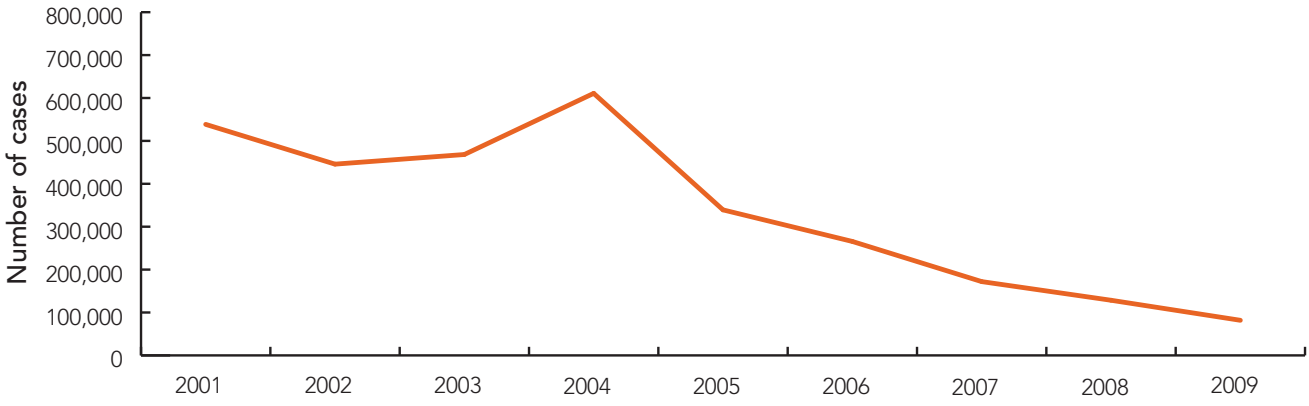
Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API), and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

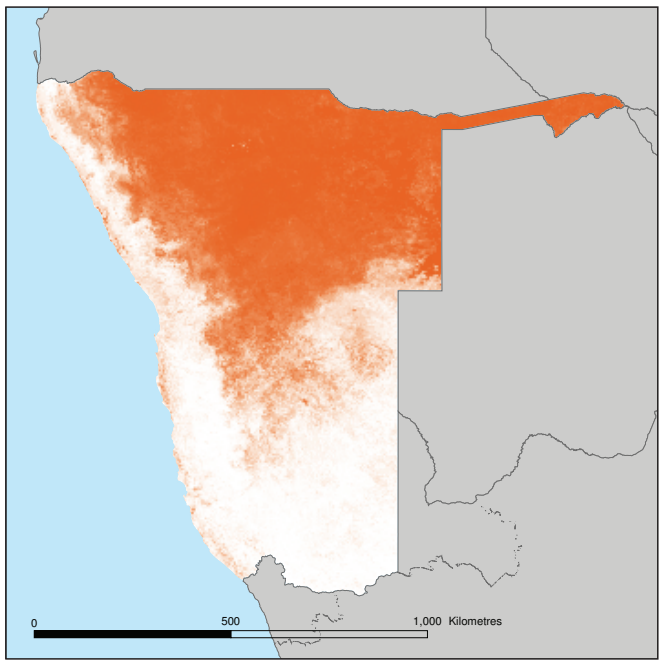
Reported Malaria Cases



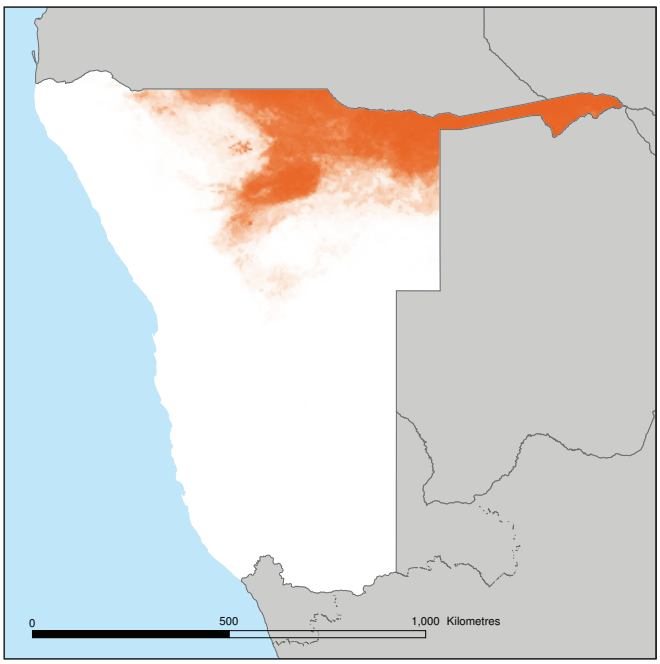
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

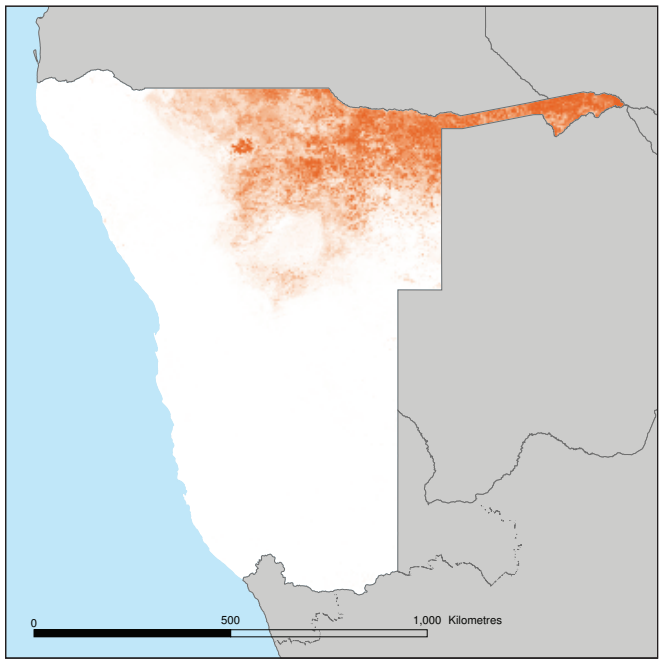
1. *Anopheles arabiensis*



2. *Anopheles funestus*



3. Nili Complex



Probability of occurrence scale

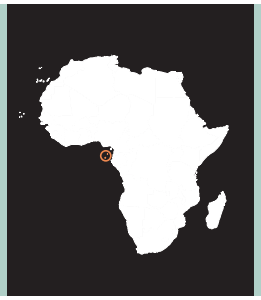
0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) funestus Giles, 1900	Important vector wherever found	Swamps, lakes edges with emergent vegetation and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) nili species complex	Malaria vector throughout range	Edges of fast-flowing streams and rivers, in degraded forest and savannah	Both	Both	Both	Dusk/ night



SÃO TOMÉ AND PRÍNCIPE

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	3,893
Deaths from malaria	23
Population at risk (%) (Total population: 165,397)	98
Annual parasite index (cases/1,000 total population/year)	23
Slide positivity rate (%)	6

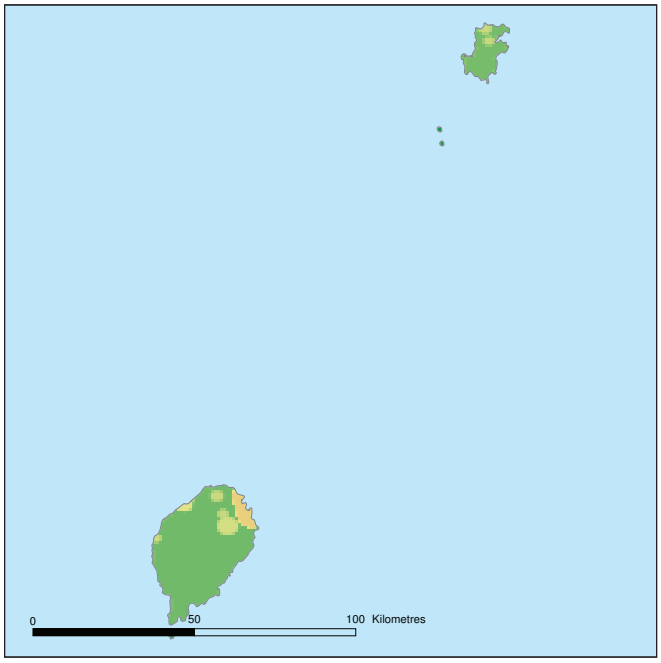
Source: WHO, World Malaria Report 2010

Health and Economic Indicators

GNI per capita (US$)	1,200
Country income level	Lower middle
Annual per capita health expenditure (US$)	91
Total health expenditure as % of GDP	7
Private health expenditure as % of total health expenditure	59
Life expectancy (years)	66

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

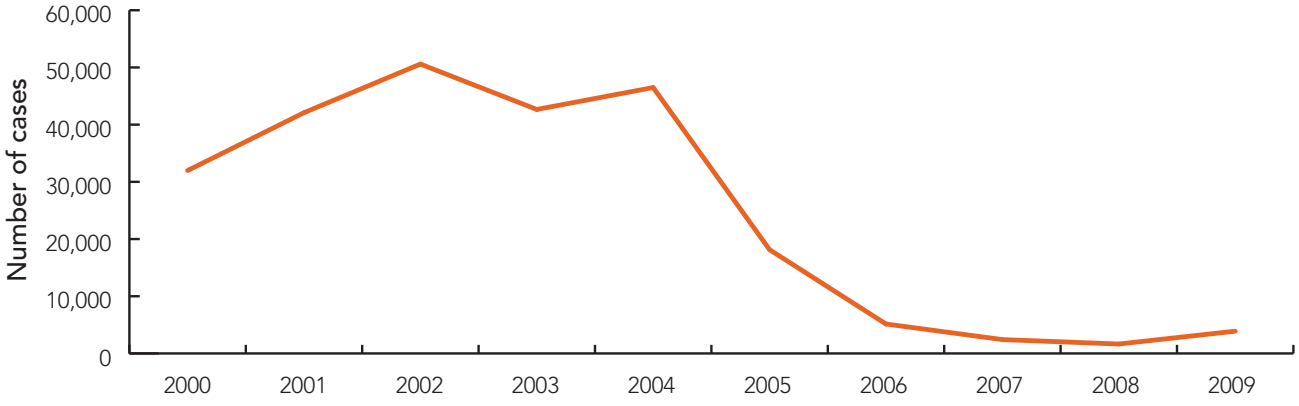
Malaria Transmission Limits

Plasmodium falciparum

P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

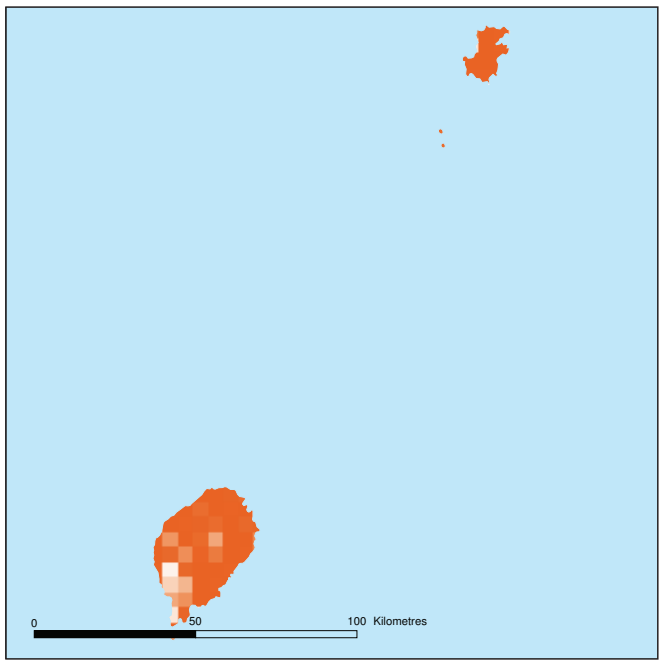
Reported Malaria Cases



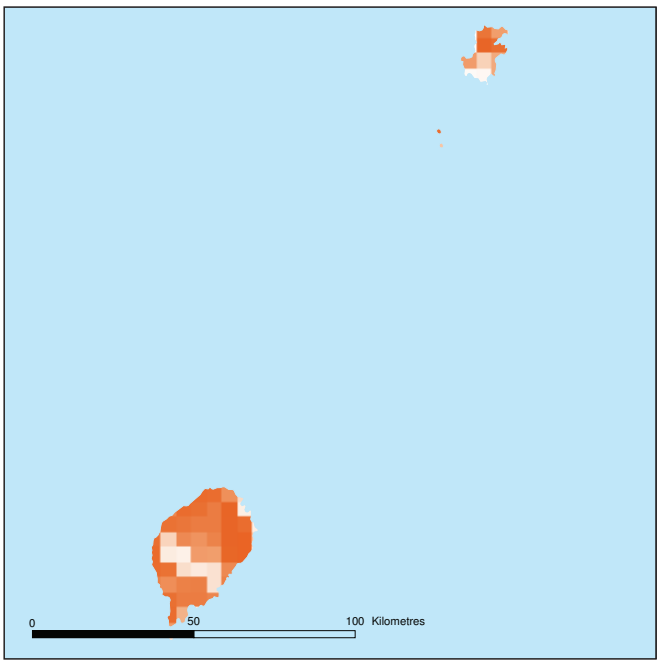
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

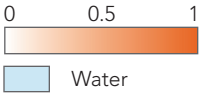
1. *Anopheles gambiae*



2. *Anopheles funestus*



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) gambiae Giles, 1902	Highly competent vector	Sunlit shallow temporary pools and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) funestus Giles, 1900	Important vector wherever found	Swamps, lakes edges with emergent vegetation and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) nili species complex; *Anopheles (Cellia) moucheti* Evans, 1925	Present but non or minor vector in São Tomé and Príncipe					

SOUTH AFRICA

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	6,072
Deaths from malaria	45
Population at risk (%) (Total population: 50 million)	10
Annual parasite index (cases/1,000 total population/year)	0.1
Slide positivity rate (%)	N/A

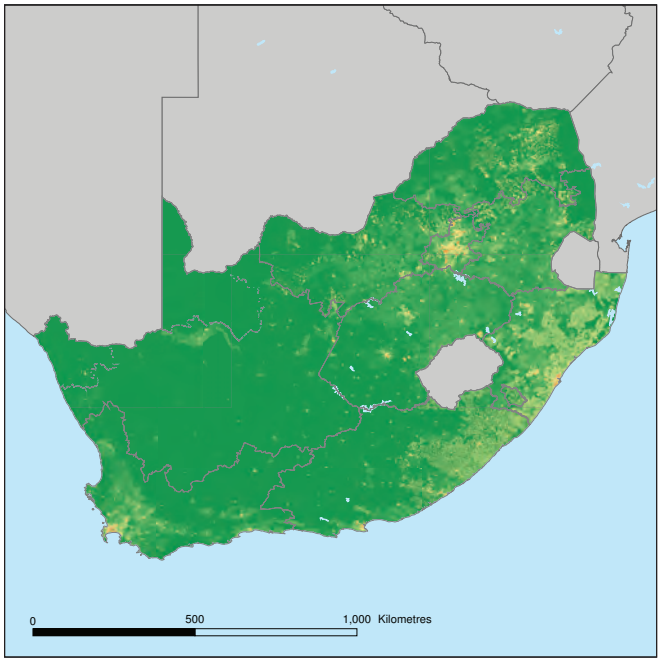
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	6,100
Country income level	Upper middle
Annual per capita health expenditure (US$)	485
Total health expenditure as % of GDP	8
Private health expenditure as % of total health expenditure	60
Life expectancy (years)	52

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

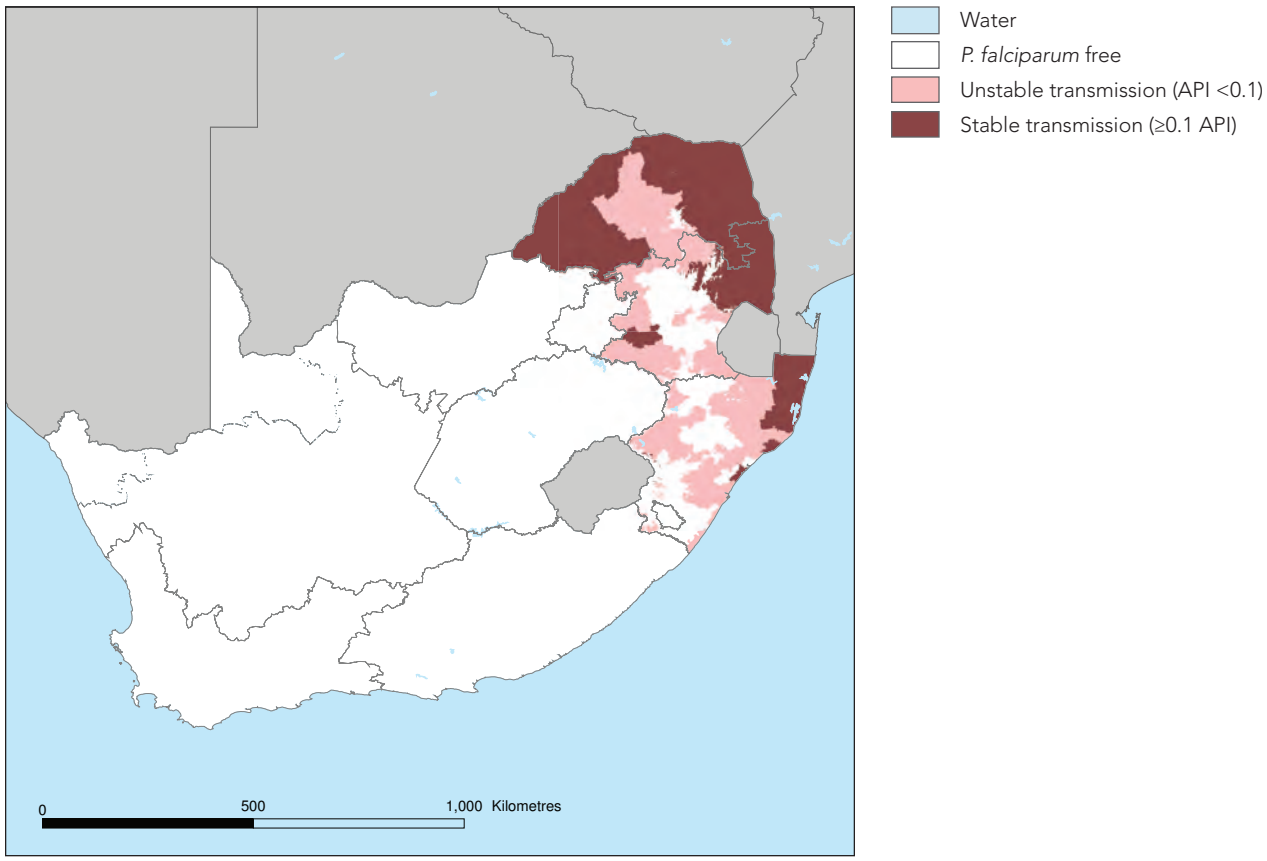
Water

Strategic Program Goal for Elimination

To eliminate local transmission of malaria by 2018

Malaria Transmission Limits

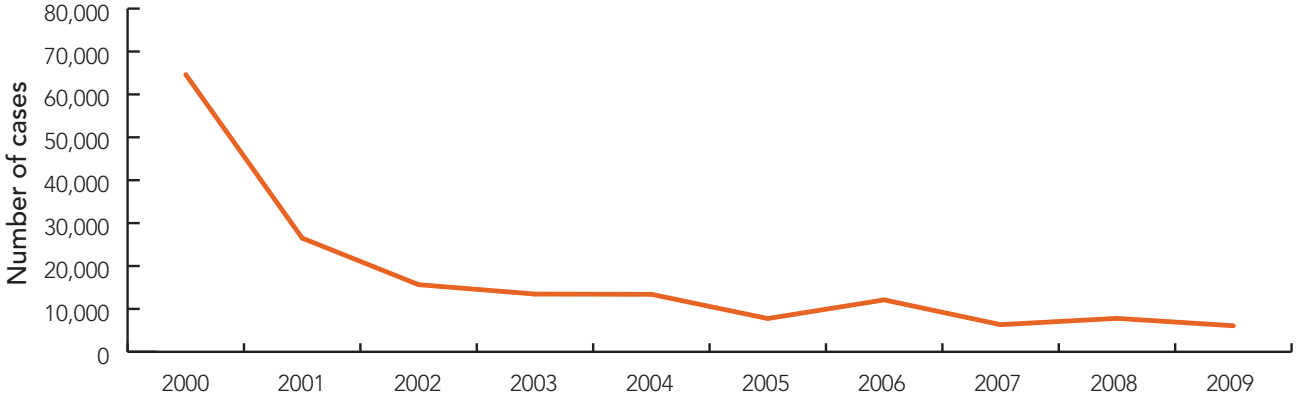
Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

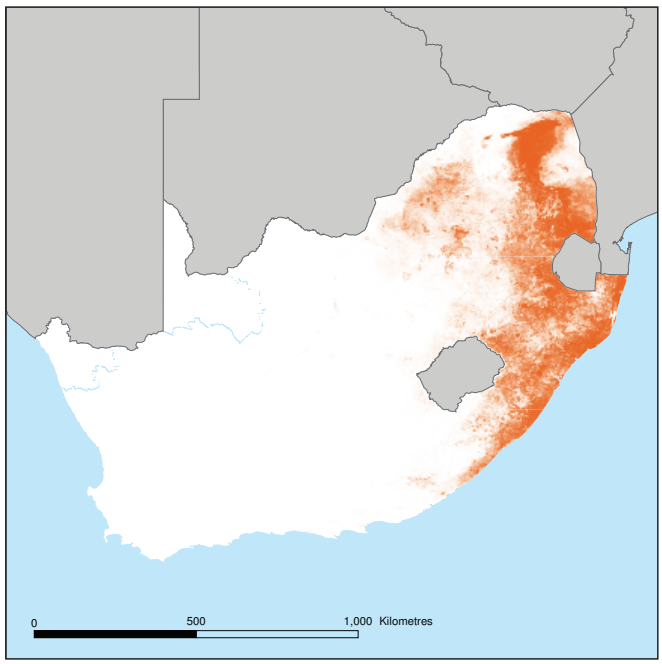
Reported Malaria Cases



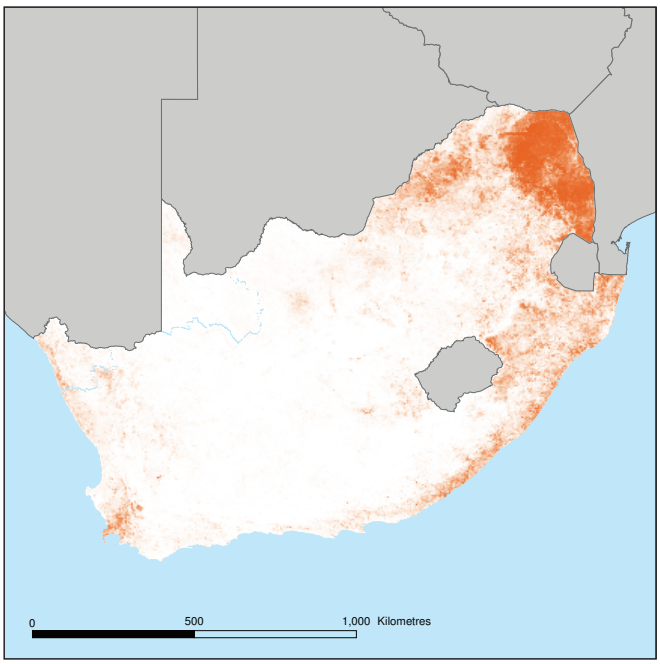
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

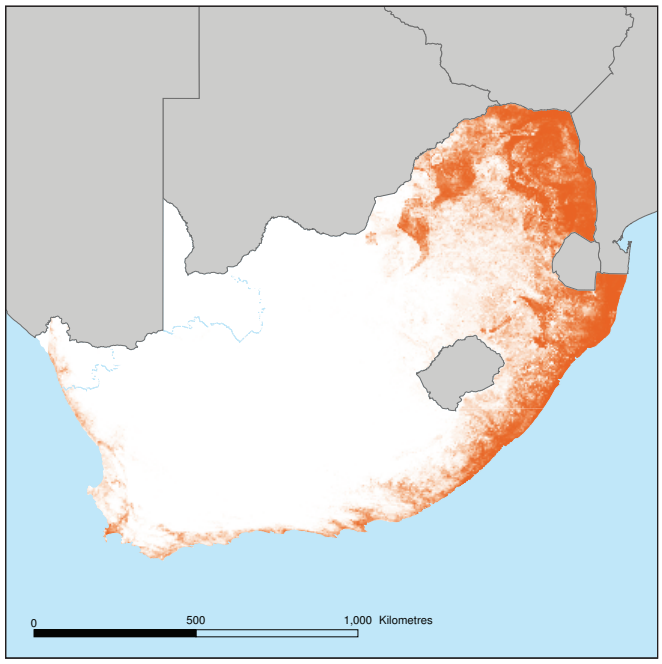
1. *Anopheles funestus*



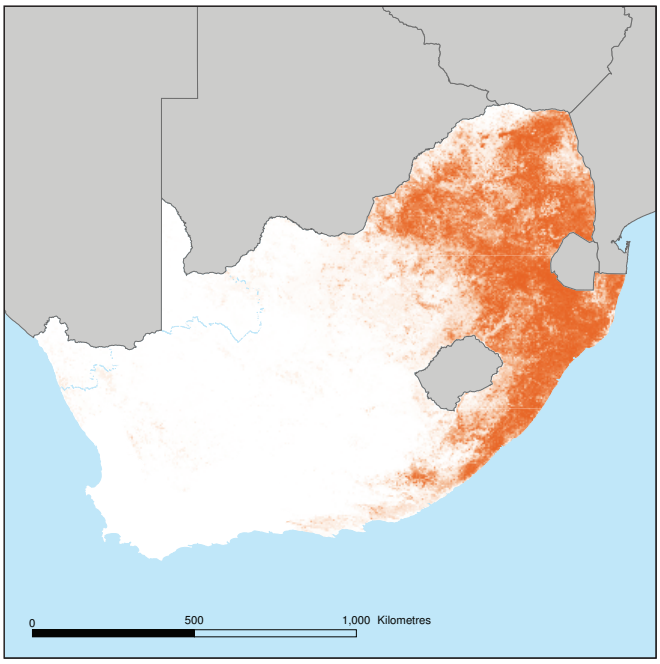
2. *Anopheles arabiensis*



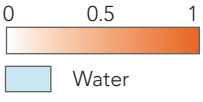
3. *Anopheles merus*



4. Nili Complex



Probability of occurrence scale



These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) funestus Giles, 1900	Important vector wherever found	Swamps, lakes edges with emergent vegetation and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) merus Dönitz, 1902	Variable depending on location	Shallow brackish pools, coastal swamps and inland salt pans	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) nili species complex	Malaria vector throughout range	Edges of fast-flowing streams and rivers, in degraded forest and savannah	Both	Both	Both	Dusk/ night

SWAZILAND

Overview

Malaria at a Glance

Reported cases of malaria (*P. falciparum* only)	106
Deaths from malaria	13
Population at risk (%) (Total population: 1.2 million)	28
Annual parasite index (cases/1,000 total population/year)	0.08
Slide positivity rate (%)	N/A

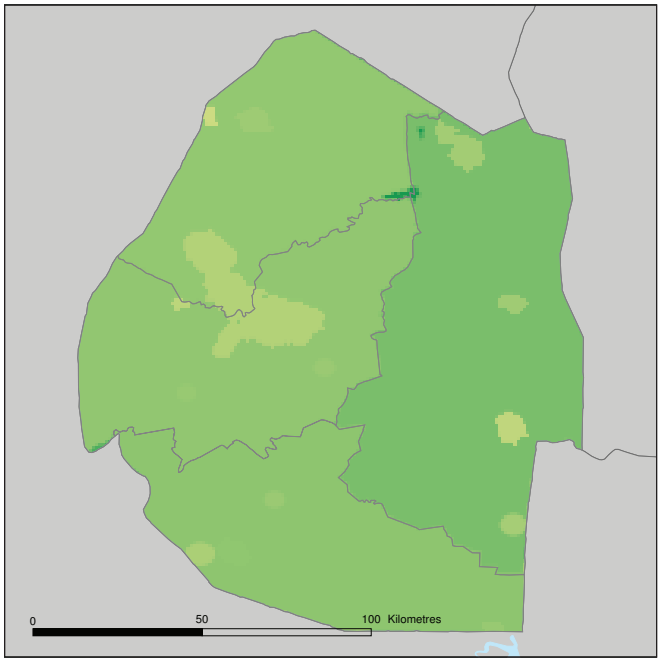
Source: WHO, World Malaria Report 2010
N/A: Data not available

Health and Economic Indicators

GNI per capita (US$)	2,600
Country income level	Lower middle
Annual per capita health expenditure (US$)	156
Total health expenditure as % of GDP	6
Private health expenditure as % of total health expenditure	36
Life expectancy (years)	46

Source: World Bank, World Development Indicators

Human Population Density



Population per km²
1,000,000
100,000
10,000
1,000
100
10
<1

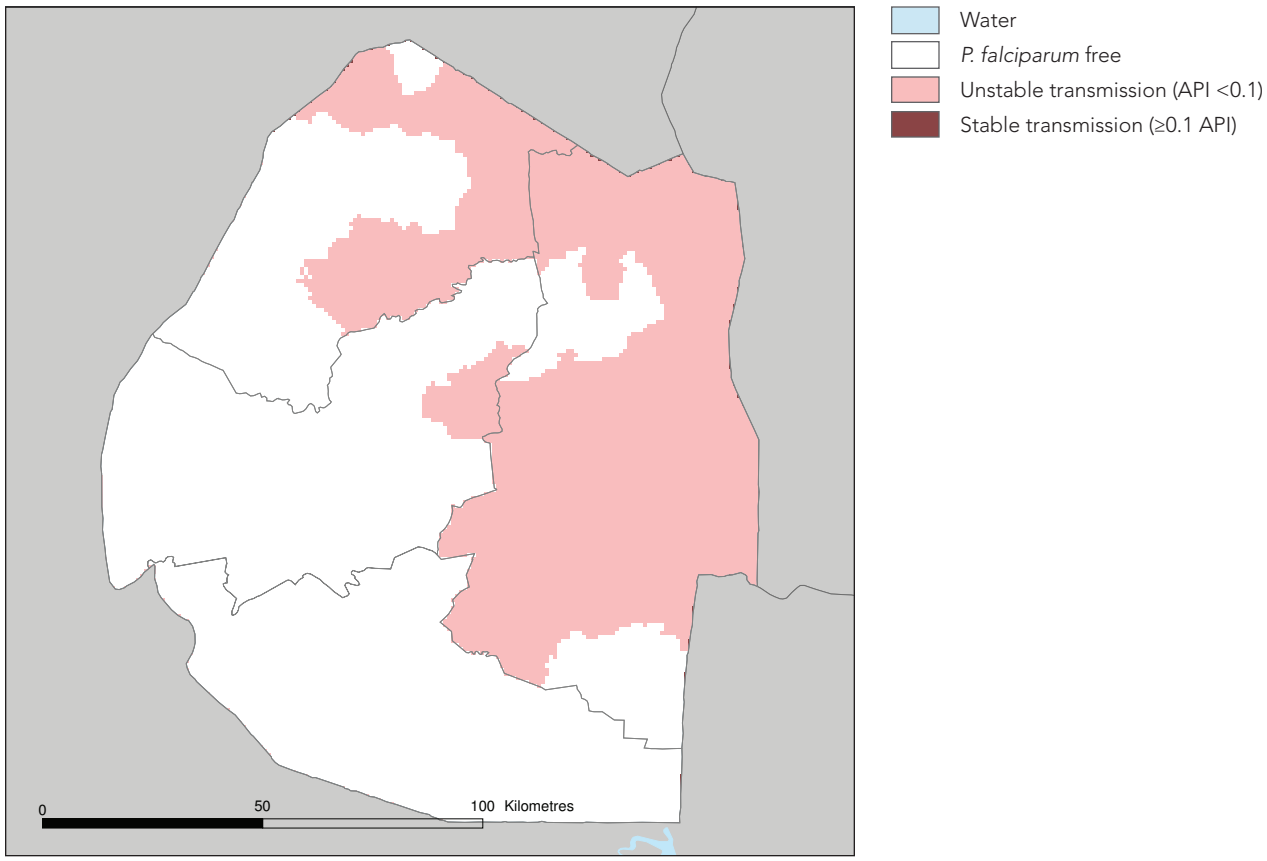
Water

Strategic Program Goal for Elimination

National malaria elimination by 2015

Malaria Transmission Limits

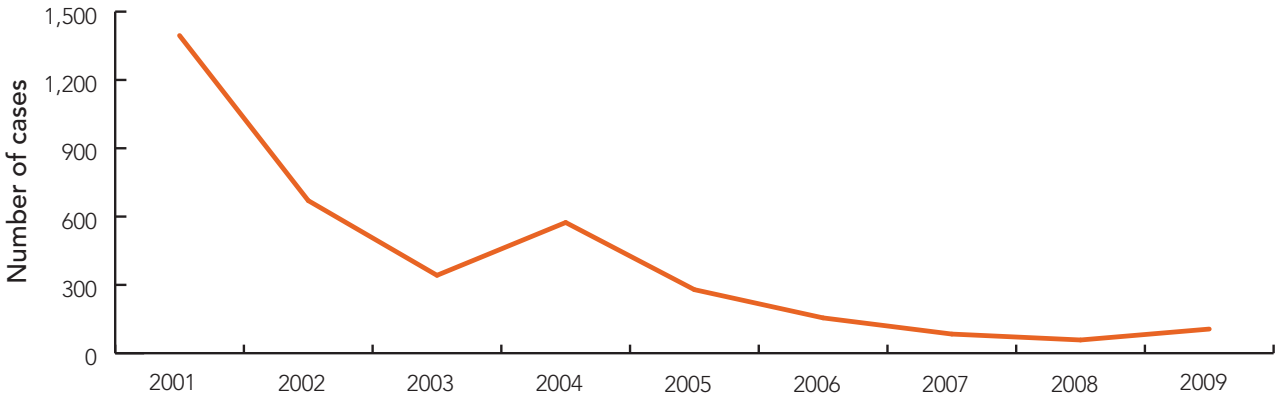
Plasmodium falciparum



P. falciparum malaria risk is classified into no risk, unstable risk of <0.1 case per 1,000 population (API) and stable risk of ≥0.1 case per 1,000 population (API). Risk was defined using health management information system data and the transmission limits were further refined using temperature and aridity data. Data from the international travel and health guidelines (ITHG) were used to identify zero risk in certain cities, islands and other administrative areas.

No *P. vivax* cases are reported, although *P. vivax* transmission is possible.

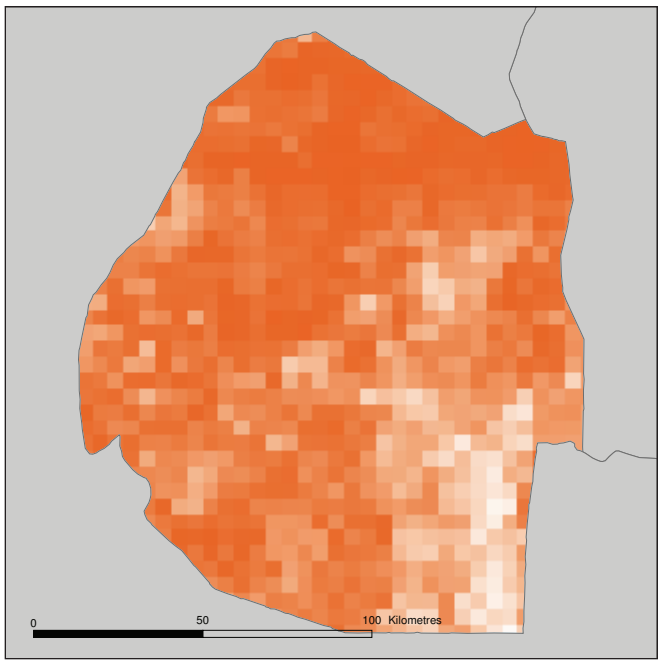
Reported Malaria Cases



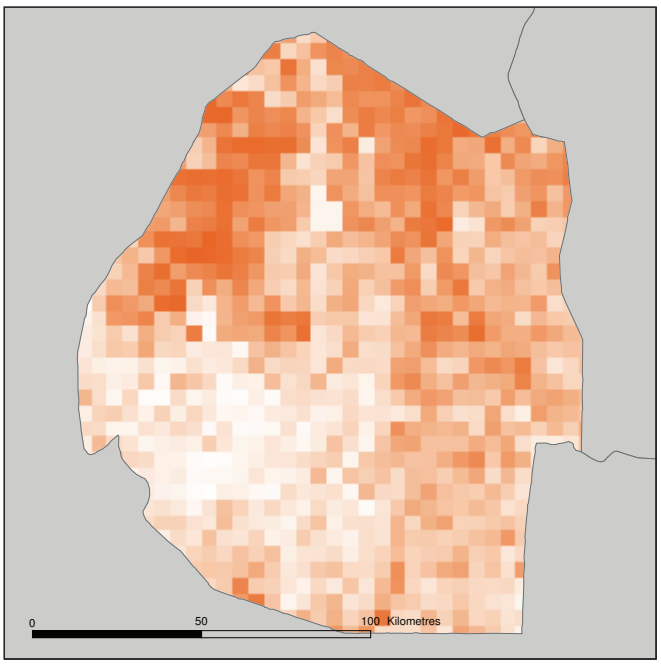
Source: WHO, World Malaria Report 2010

Occurrence of Malaria Vector Species

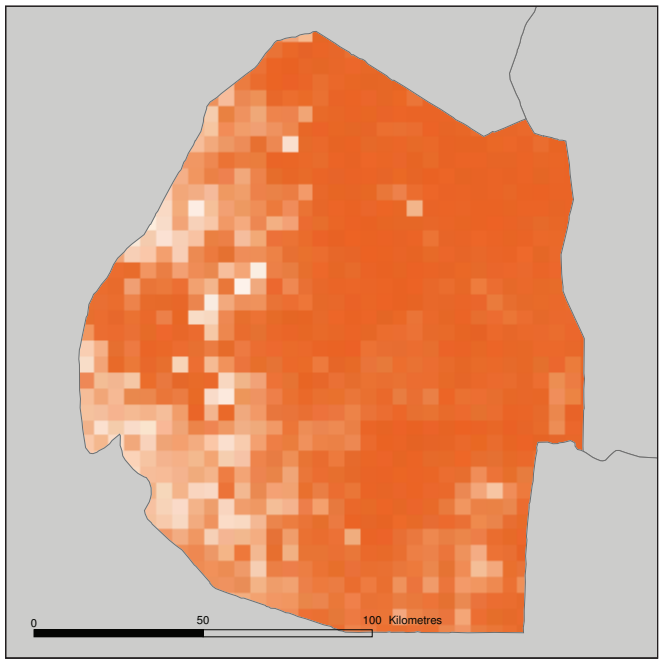
1. *Anopheles funestus*



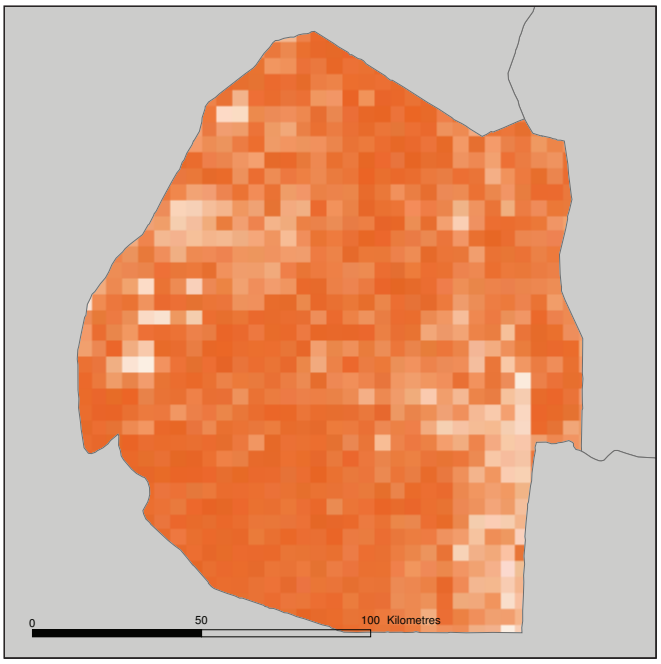
2. *Anopheles arabiensis*



3. *Anopheles merus*



4. Nili Complex



Probability of occurrence scale

0 0.5 1

Water

These maps show the predicted probability of occurrence of each vector species.

Bionomics Vector Species Table

Species	Vector status across species range	Primary environment	Zoophilic/ anthropophilic	Endo/ exophagic	Endo/ exophilic	Biting time
Anopheles (Cellia) funestus Giles, 1900	Important vector wherever found	Swamps, lakes edges with emergent vegetation and rice fields	Anthropophilic/ both	Endophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) arabiensis Patton, 1905	Variable depending on location	Dry savannah, sparse woodland and rice fields	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) merus Dönitz, 1902	Variable depending on location	Shallow brackish pools, coastal swamps and inland salt pans	Both	Exophagic/ both	Both	Dusk/ night/ dawn
Anopheles (Cellia) nili species complex	Malaria vector throughout range	Edges of fast-flowing streams and rivers, in degraded forest and savannah	Both	Both	Both	Dusk/ night

Summary Table: Malaria at a Glance

Country	Reported Cases of Malaria	*Plasmodium* Parasite	Deaths From Malaria	Population At Risk (% of Total Population)	Annual Parasite Index (Cases/1,000 Total Population/ Year)	Slide Positivity Rate (%)
Algeria*	3	N/A	0	7	0.005	1.6
Argentina	154	*P. vivax* only	0	9	0.003	N/A
Azerbaijan	78	*P. vivax* only	0	2	0.009	0.01
Belize	256	*P. vivax* only	0	61	0.7	1
Bhutan	972	56% *P. falciparum*	4	73	1.4	1.6
Botswana	14,878	*P. falciparum* only	6	63	7	N/A
Cape Verde	65	*P. falciparum* only	2	25	0.1	0.3
China	9,287	88% *P. vivax*	12	52	0.01	0.2
Costa Rica	262	99% *P. vivax*	1	36	0.05	5.4
Democratic People's Republic of Korea	14,322	*P. vivax* only	N/A	49	0.6	N/A
Dominican Republic	1,643	*P. falciparum* only	14	79	0.1	0.4
El Salvador	20	95% *P. vivax*	0	83	0.003	0.02
Georgia	1	*P. vivax* only	0	1	0.0002	0.2
Iran	4,477	90% *P. vivax*	N/A	16	0.06	0.6
Iraq	0	None	0	12	0	0
Kyrgyzstan	4	*P. vivax* only	0	0.1	0.0007	0.01
Malaysia	6,426	53% *P. vivax*	N/A	4	0.2	0.4
Mexico	2,703	99% *P. vivax*	0	5	0.04	0.2
Namibia	81,812	*P. falciparum* only	46	70	37	N/A
Nicaragua	610	85% *P. vivax*	0	83	0.1	0.1
Panama	770	99% *P. vivax*	N/A	96	0.2	0.5
Paraguay	91	89% *P. vivax*	0	68	0.01	0.1
Philippines	19,198	70% *P. falciparum*	24	78	0.2	5.4
Republic of Korea	1,317	*P. vivax* only	N/A	7	0.02	N/A
São Tomé and Príncipe	3,893	*P. falciparum* only	23	98	23	6
Saudi Arabia	58	70% *P. falciparum*	0	50	0.002	0.005
Solomon Islands	33,002	59% *P. falciparum*	53	97	61	14
South Africa	6,072	*P. falciparum* only	45	10	0.1	N/A
Sri Lanka	531	96% *P. vivax*	N/A	23	0.02	0.06
Swaziland	106	*P. falciparum* only	13	28	0.08	N/A
Tajikistan	164	*P. vivax* only	0	33	0.02	0.1
Thailand	31,771	43% *P. vivax*	70	50	0.4	1.7
Turkey	38	*P. vivax* only	1	0.02	0.0005	0.006
Uzbekistan	0	None	0	0	0	0
Vanuatu	3,915	41% *P. vivax*	2	99	16	16
Vietnam	16,130	79% *P. falciparum*	26	90	0.2	0.5

N/A: Data not available
Source: World Malaria Report 2010, World Health Organization
*Source: World Malaria Report 2009, World Health Organization

Summary Table: Health and Economic Indicators

Country	Total Population (Millions)	GNI Per Capita (US$)	Annual Per Capita Health Expenditure (US$)	Total Health Expenditure as % of GDP	Private Health Expenditure as % of Total Health Expenditure	Life Expectancy at Birth (Years)
Low Income						
Democratic People's Republic of Korea*	23.8	555	1	3	14	67
Kyrgyzstan	5.3	880	57	7	49	69
Tajikistan	6.8	800	38	5	67	67
Lower Middle Income						
Belize	0.3	3,740	217	5	27	77
Bhutan	0.7	1,920	98	5	18	67
Cape Verde	0.5	3,160	146	4	26	71
El Salvador	6.2	3,360	229	6	40	71
Georgia	4.4	2,690	256	10	71	73
Iraq	32.3	2,340	98	4	28	68
Nicaragua	5.8	1,080	105	9	43	73
Paraguay	6.5	2,940	159	7	57	72
Philippines	93.6	2,050	67	4	65	72
São Tomé and Príncipe	0.1	1,200	91	7	59	66
Solomon Islands	0.5	1,030	72	5	6	67
Sri Lanka	20.5	2,290	84	4	55	74
Swaziland	1.2	2,600	156	6	36	46
Uzbekistan	28.2	1,280	62	5	53	68
Vanuatu	0.2	2,760	106	4	18	71
Vietnam	88.4	1,100	80	7	61	75
Upper Middle Income						
Algeria	35.4	4,460	268	6	14	73
Argentina	40.7	8,450	730	9	34	76
Azerbaijan	9	5,080	285	6	76	70
Botswana	2	6,890	612	10	20	55
China	1,300	4,260	177	5	50	73
Costa Rica	4.6	6,580	668	10	33	79
Dominican Republic	10.2	4,860	271	6	59	73
Iran	74	4,520	269	5	61	72
Malaysia	27.9	7,900	336	5	55	75
Mexico	108.5	9,330	515	6	52	75
Namibia	2.2	4,650	258	6	34	62
Panama	3.5	6,980	591	8	28	76
South Africa	50	6,100	485	8	60	52
Thailand	68.1	4,210	168	4	24	69
Turkey	72.7	9,890	571	7	25	73
High Income						
Republic of Korea	48.9	19,890	1,108	6	46	80
Saudi Arabia	27.4	16,190	714	5	33	74

Source: World Bank, World Development Indicators. http://data.worldbank.org
*Source: World Health Organization, World Health Statistics; United Nations Statistics Division

Acronyms

API	Annual parasite index or annual parasite incidence
APMEN	Asia Pacific Malaria Elimination Network
GDP	Gross domestic product
GNI	Gross national income
G6PD	Glucose-6-phosphate dehydrogenase
ITHG	International travel and health guidelines
MAP	Malaria Atlas Project
SPR	Slide positivity rate
US$	United States Dollars
WHO	World Health Organization
WWARN	Worldwide Antimalarial Resistance Network

Appendix A: Sources and Citations for the Strategic Program Goals for Elimination

A variety of sources were compiled for individual malaria-eliminating countries where national and subnational goals for elimination could be identified. Included below are sources listed by region and country.

Asia Pacific

Bhutan

Bhutan National Strategic Plan 2012–2016. Vector-borne Disease Control Program (VDCP), Bhutan. www.health.gov.bt.

China

- (Chinese) National malaria program website: http://www.moh.gov.cn/publicfiles//business/htmlfiles/mohjbyfkzj/s2911/list.htm.
- (English) Professor Gao Qi. From passive to active malaria surveillance in China. (2010) Jiangsu Institute of Parasitic Diseases, People's Republic of China. Meeting presentation at the second Asia Pacific Malaria Elimination Network Meeting, http://apmen.org/storage/apmen-ii/03Gao.pdf.

Democratic People's Republic of Korea

The Global Fund to Fight AIDS, Tuberculosis, and Malaria. Democratic People's Republic of Korea Round 8 proposal: Aiming for the pre-elimination of malaria in the Democratic People's Republic of Korea through an expanded and comprehensive approach to malaria control programming. 2008.

Malaysia

Kheong CC. Country Updates Malaysia. Executive Board Meeting presentation, Asian Collaborative Training Network for Malaria (ACTMalaria); March 15–17, 2010; Lao PDR.

Philippines

Philippines: Country Updates. Executive Board Meeting presentation, Asian Collaborative Training Network for Malaria (ACTMalaria); March 15–17, 2010; Lao PDR.

Republic of Korea

Han-Sung L. Malaria in the Republic of Korea. Presentation at the 2nd annual meeting of the Asia Pacific Malaria Elimination Network. February 16–19, 2010, Kandy, Sri Lanka. http://apmen.org/storage/apmen-ii/03Lee.pdf.

Sri Lanka

Sri Lanka Anti-Malaria Campaign. Strategic Plan for Phased Elimination of Malaria 2008–2012. Colombo: Sri Lanka Anti-Malaria Campaign, 2008.

Solomon Islands

- National Malaria Strategic Vision 2007–2016. Solomon Islands. Asia Pacific Malaria Elimination Network (APMEN) website — Country Resources. http://apmen.org/storage/country-partner/Solomon Islands-National Vision Statement.pdf.
- Atkinson J, Bobogare A, Fitzgerald L, Boaz L, Appleyard B, Toaliu H, Vallely A. A qualitative study on the acceptability and preference of three types of long-lasting insecticide-treated bed nets in Solomon Islands: implications for malaria elimination. *Malaria* 2009, 8: 119. http://www.malariajournal.com/content/pdf/1475-2875-8-119.pdf.

Thailand

- The Global Fund to Fight AIDS, Tuberculosis and Malaria. Thailand Round 7 CCM proposal: Partnership towards malaria reduction in migrants and conflict-affected populations in Thailand; 2007.
- Malaria in the Greater Mekong Subregion: regional and country profiles (2010). World Health Organization: Offices of the South-East Asia Region and the Western Pacific Region. http://www.searo.who.int/LinkFiles/Malaria_MAL-260.pdf.

Vanuatu

- National Malaria Strategic Vision 2007–2016. Vanuatu. Asia Pacific Malaria Elimination Network (APMEN) website–Country Resources. http://apmen.org/storage/country-partner/Vanuatu-National Vision Statement.pdf.

- Tynan, EA, Community participation for malaria elimination in Tafea Province, Vanuatu: Part II. Social and cultural aspects of treatment-seeking behaviour. *Malaria*, 2011. 10(204). http://www.malariajournal.com/content/10/1/204/abstract.

Vietnam

- The Global Fund to Fight AIDS, Tuberculosis and Malaria. Vietnam Round 7 CCM proposal: Intensify community-based malaria control targeting key risk groups, and enhance the functionality and sustainability of Vietnam's malaria control efforts. 2007.
- National Strategy for Malaria Control and Elimination period 2011–2020 and Vision to 2030 in Vietnam. Institute of Malariology, Parasitology and Entomology, Quy Nhon. 2011. http://www.impe-qn.org.vn/impe-qn/en/portal/InfoPreview.jsp?ID=606.

Latin America and Caribbean

No goals were identified for: Argentina, Belize, Costa Rica, El Salvador or Panama.

Dominican Republic

- The Carter Center. The Hispaniola Initiative: Catalyzing the Elimination of Malaria and Lymphatic Filariasis from the Caribbean, 2009. http://www.cartercenter.org/health/hispaniola-initiative/index.html.
- The Global Fund to Fight AIDS, Tuberculosis and Malaria. Dominican Republic Round 8 proposal: Strengthen the fight against malaria in vulnerable populations of municipalities with high incidence in the Dominican Republic, 2008.

Mexico

Secretaría de Salud. Programa de Accion Especifico 2007–2012 Paludismo, 2008. http://salud.edomex.gob.mx/html/doctos/zoonosis/03 Programa Nacional de Paludismo.pdf.

Nicaragua

The Global Fund to Fight AIDS, Tuberculosis and Malaria. Nicaragua Round 9 proposal: Stop the local transmission of malaria, focused upon pre-elimination in 37 of the country's municipalities, 2009.

Paraguay

The Global Fund to Fight AIDS, Tuberculosis and Malaria. Paraguay Round 8 proposal: Towards the elimination of malaria in Paraguay, 2008.

North Africa, Europe, Middle East, Central Asia

No goals were identified for Iraq.

Algeria

African Union. Fight Malaria: Africa goes from control to elimination by 2010. Advocacy Strategy Document. Johannesburg, South Africa: African Union; 2007 April 9–13.

Azerbaijan

Ibrahimov F, Ibrahimova A, Kehler J, Richardson E (eds) (2010). Azerbaijan Health System Review: Health Systems in Transition. Vol. 12, No. 3. http://www.euro.who.int/__data/assets/pdf_file/0004/118156/E94132.pdf.

Georgia

WHO. World Malaria Report 2010. Geneva: World Health Organization. http://www.who.int/malaria/world_malaria_report_2010/en/index.html.

Iran

- UNDP. The Prevention and Control of Malaria in the Islamic Republic of Iran, Phase 1 & 2. (2009) http://www.undp.org.ir/index.php/hivaids-tb-malaria/93-the-prevention-and-control-of-malaria-inthe-i-r-of-iran-phase-1.

- The Global Fund to Fight AIDS, Tuberculosis and Malaria. Islamic Republic of Iran Round 10 proposal: Elimination of falciparum malaria in priority areas in the Islamic Republic of Iran. 2010.

Kyrgyzstan

The Tashkent Declaration. From Malaria Control to Elimination 2006 – 2015 in the WHO European Region. (2006) World Health Organization Regional Office for the European Region.

Saudi Arabia

- Informal consultation on malaria elimination: setting up the WHO agenda, Tunis, February 2006
- World Health Organization. http://whqlibdoc.who.int/hq/2006/WHO_HTM_MAL_2006.1114_eng.pdf.

Tajikistan

- WHO. World Malaria Report 2010. Geneva: World Health Organization. http://www.who.int/malaria/world_malaria_report_2010/en/index.html
- The Tashkent Declaration. From Malaria Control to Elimination 2006–2015 in the WHO European Region. (2006) World Health Organization Regional Office for the European Region.

Turkey

- WHO/EURO. Malaria Progress with Programme Implementation. 2010. World Health Organization Regional Office of the European Region. http://www.euro.who.int/en/what-we-do/health-topics/diseases-and-conditions/malaria/country-work/turkey/progress-with-programme-implementation.
- WHO. World Malaria Report 2010. Geneva: World Health Organization. http://www.who.int/malaria/world_malaria_report_2010/en/index.html.

Uzbekistan

- WHO. Uzbekistan: Progress with program implementation. World Health Organization, 2008. http://www.euro.who.int/en/what-we-do/health-topics/diseases-and-conditions/malaria/country-work/tajikistan/progress-with-programme-implementation.
- The Tashkent Declaration. From Malaria Control to Elimination 2006 – 2015 in the WHO European Region. (2006) World Health Organization Regional Office for the European Region.

Sub-Saharan Africa

Botswana

- Malaria Strategic Plan: Towards malaria elimination, 2010–2015. Ministry of Health: Botswana, 2010.
- African Union. Fight Malaria: Africa goes from control to elimination by 2010. Advocacy Strategy Document. Johannesburg, South Africa: African Union; 2007 April 9–13.

Cape Verde

African Union. Fight Malaria: Africa goes from control to elimination by 2010. Advocacy Strategy Document. Johannesburg, South Africa: African Union; 2007 April 9–13.

Namibia

- Namibia Malaria Strategic Plan 2010–2016, Republic of Namibia: Ministry of Health and Social Services, 2010.
- National Vector-Borne Diseases Control Programme: Annual Report 2010/2011. Republic of Namibia: Ministry of Health and Social Services.

São Tomé and Príncipe

African Union. Fight Malaria: Africa goes from control to elimination by 2010. Advocacy Strategy Document. Johannesburg, South Africa: African Union; 2007 April 9–13.

South Africa

Malaria Elimination Strategy 2011–2018. National Department of Health: South Africa, 2011.

Swaziland

- Swaziland National Malaria Elimination Policy, National Malaria Control Programme, Ministry of Health, 2010.
- African Union. Fight Malaria: Africa goes from control to elimination by 2010. Advocacy Strategy Document. Johannesburg, South Africa: African Union; 2007 April 9–13.

Appendix B: Annual Parasite Incidence Data Sources for the Transmission Limits Maps

Country	Data Years	Data Source(s)
Argentina	2008	World Health Organization, Geneva, Swiss Confederation
Azerbaijan	2005–2008	Elkhan Gasimov (2009), World Health Organization/Regional Office for Europe, Baku, Republic of Azerbaijan
Belize	2005–2008	Health Statistics of Belize 2004 to 2008 (2009), Epidemiology Unit, Ministry of Health, Belmopan City, Belize
Bhutan	2007–2010	Thinley Yangzom, Sonam Gyeltshen and Karma Lhazeen, (2010), Vector-Borne Disease Control Programme, Department of Public Health and Ministry of Health, Gelephu, Kingdom of Bhutan
Botswana	2009–2010	Centers for Disease Control and Prevention (2009) CDC Health Information for International Travel 2010, U.S Department of Health and Human Services, Public Health Service, Atlanta, USA; World Health Organization International Travel and Health (as at 1 January 2010), Geneva, Switzerland
Cape Verde	2009–2009	Ministério da Saúde de Cabo Verde, Direcção Geral de Saúde, Programa Nacional de Luta Contra o Paludismo (2009), Plano Estratégico de Pré-Eliminação do Paludismo 2009–2013, Cabo Verde
China	2004–2007	World Health Organization/Regional Office for the Western Pacific (2009), Manila, Republic of the Philippines, URL: http://www.wpro.who.int/sites/mvp/epidemiology/malaria
Costa Rica	2006	Vigilancia de la Salud, Ministerio de Salud, San José, Costa Rica, URL: http://www.ministeriode-salud.go.cr/index.php/inicio-estadisticas-vigilancia-salud-ms
Democratic People's Republic of Korea	2006–2008	Rakesh M. Rastogi (2010), World Health Organization/Regional Office for South-East Asia, New Delhi, Republic of India
Dominican Republic	2008	David Joa (2009), Centro de Control de Enfermedades Tropicales, Ministerio de Salud Pública y Asistencia Social, Santo Domingo (DN), Dominican Republic
El Salvador	2006	Status of malaria in the Americas, 1994–2007: a series of data tables, World Health Organization/ Pan American Health Organization (Regional Office for the Americas), Washington D.C., United States of America, URL: http://www.paho.org/English/AD/DPC/CD/mal-americas-2007.pdf
Georgia	2007–2010	Merab Iosava and Irine Kalandadze, Outbreak and Bioterrorism Response Division, National Center for Disease Control and Public Health, Georgia; Giorgi Kurtsikashvili, World Health Organization Country Office in Georgia
Iran	2007–2008	World Health Organization/Regional Office for the Eastern Mediterranean (2009), Cairo, Arab Republic of Egypt
Iraq	2005–2008	World Health Organization/Regional Office for the Eastern Mediterranean (2009), Cairo, Arab Republic of Egypt
Kyrgyzstan	2009–2010	Centers for Disease Control and Prevention (2009) CDC Health Information for International Travel 2010, U.S Department of Health and Human Services, Public Health Service, Atlanta, USA; World Health Organization International Travel and Health (as at 1 January 2010), Geneva, Switzerland
Malaysia	2005, 2007, 2009–2010	Christina Rundi (2009), Disease Control Division, Ministry of Health, Malaysia; World Health Organization/Regional Office for the Western Pacific, Manila, Republic of the Philippines, URL: www.wpro.who.int/sites/mvp/epidemiology/malaria
Mexico	2005–2008	Juan E. Hernandez (2009), Instituto Nacional de Salud Pública, Cuernavaca, Mexico
Namibia	2009	Snow RW, Alegana VA, Makomva K, Reich A, Uusiku P, et al. (2010), Estimating the distribution of malaria in Namibia in 2009: assembling the evidence and modeling risk, Ministry of Health and Social Services, Republic of Namibia and the Malaria Atlas Project
Nicaragua	2004, 2006–2007	Boletines epidemiologicos (2009), Dirección de Vigilancia Epidemiológica, Ministerio de Salud, Managua, Republic of Nicaragua, website: http://www.minsa.gob.ni/vigepi/html/boletin.html
Panama	2006–2007	Jose E. Calzada (2009), Departamento de Control de Vectores, Ministerio de Salud, Panama City, Panama

Paraguay	2008	Servicio Nacional de Erradicación del Paludismo (2009), Ministerio de Salud Pública y Bienestar Social, Asunción, Republic of Paraguay
Philippines	2004–2007	Dorina G Bustos (2009), Research Institute for Tropical Medicine and Malaria Control Program & Ma. Cristina Galang, Malaria Control Program, Department of Health, Manila, Philippines
Republic of Korea	2005–2008	Jung-Yeon Kim (2009), Department of Malaria and Parasitic Disease, National Institute of Health, Seoul, Republic of Korea
São Tomé and Príncipe	1998–2001	Gautret P, Legros F, Koulmann P, Rodier MH, Jacquemin JL (2001) Imported Plasmodium vivax malaria in France: geographical origin and report of an atypical case acquired in Central or Western Africa. Acta Trop 78: 177–181; Snounou G, Pinheiro L, Antunes AM, Ferreira C, do Rosario VE (1998) Non-immune patients in the Democratic Republic of Sao Tome e Príncipe reveal a high level of transmission of P. ovale and P. vivax despite low frequency in immune patients. Acta Trop 70: 197–203
Saudi Arabia	2005–2006	World Health Organization/Regional Office for the Eastern Mediterranean, Cairo, Arab Republic of Egypt
Solomon Islands	2003–2005, 2007	Malaria epidemiology (2009), Solomon Islands, World Health Organization/Regional Office for the Western Pacific, Manila, Republic of the Philippines, URL: http://www.wpro.who.int/sites/mvp/epidemiology/malaria/
South Africa	2006–2009	Rajendra Maharaj (2010), Malaria Research Program, Medical Research Council, Durban, Republic of South Africa
Sri Lanka	2007–2010	Gawrie N. Galappaththy (2009), National Malaria Control Programme, Ministry of Health (2010), Colombo, Democratic Socialist Republic of Sri Lanka
Swaziland	2007, 2009	Malaria Elimination Strategy 2008–15, National Malaria Control Programme, Ministry of Health, Manzini, Kingdom of Swaziland
Tajikistan	2005–2008	Nargis Saparova (2009), World Health Organization/Country Office in Tajikistan, Dushanbe, Republic of Tajikistan
Thailand	2007–2010	Supawadee Poungsombat, Jirapat Ketkaew and Wichai Satimai, (2009), Bureau of Vector Borne Diseases, Department of Disease Control, Ministry of Public Health, Thailand
Turkey	2008–2008	Seher Topluoğlu (2009), Malaria Control Department, Ministry of Health, Ankara, Republic of Turkey
Uzbekistan	2009–2010	Centers for Disease Control and Prevention (2009) CDC Health Information for International Travel 2010, U.S. Department of Health and Human Services, Public Health Service, Atlanta, USA; World Health Organization International Travel and Health (as at 1 January 2010), Geneva, Switzerland
Vanuatu	2003–2005, 2007	World Health Organization/Regional Office for the Western Pacific (2009), Manila, Republic of the Philippines, URL: http://www.wpro.who.int/sites/mvp/epidemiology/malaria
Vietnam	2005–2008	Nguyen Manh Hung (2008), National Institute of Malariology, Parasitology and Entomology, Ministry of Health, Ha Noi City, Socialist Republic of Vietnam

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Malaria-Eliminating Countries

Algeria | Argentina | Azerbaijan | Belize | Bhutan
Botswana | Cape Verde | China | Costa Rica
Democratic People's Republic of Korea
Dominican Republic | El Salvador | Georgia | Iran | Iraq
Kyrgyzstan | Malaysia | Mexico | Namibia | Nicaragua
Panama | Paraguay | Philippines | Republic of Korea
São Tomé and Príncipe | Saudi Arabia | Solomon Islands
South Africa | Sri Lanka | Swaziland | Tajikistan | Thailand
Turkey | Uzbekistan | Vanuatu | Vietnam

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