

lobby is not going to be satisfied with just a moratorium on *Bt* brinjal. They are baying for complete banning of GM crops and in fact are demanding complete stoppage of research and teaching in modern biotechnology. In the name of 'democratization of science' they want a sea at the decision making table to decide on research priorities and funding. If sometime in future another politician succumbs to this demand, then, there is no telling what will happen to the future of Indian science and technology.

Another strange thing in this anti-GM campaign is that almost everybody in the country seems to have an opinion (mostly negative) on GM crops except the scientific community. The power of political

mobilization is such that faded or fading film stars, film directors, poets, writers, journalists, politicians, and some college teachers and students cheer-lead by a couple of 'had-been' scientists have created an impression that the entire citizenry of the country is against GM crops. It is really disheartening that the Indian science community, save for a couple of exceptions, has been largely missing in action in this debate as if it is none of their business. However, there are murmurs by some affected plant scientists who have woken up from their slumber after the minister's decision. It is really too late and too little. If the Indian scientific community does not realize how affairs of science are going to be con-

trolled, then they will have only themselves to blame. Indian science and technology now stands completely politicized and unless the scientists (at least some of them) are willing to play the same game, there is a good chance that Indian science will be controlled by street level activists and shouting brigades motivated by ideology and politics. The *Bt* brinjal episode must serve as a real wake up call.

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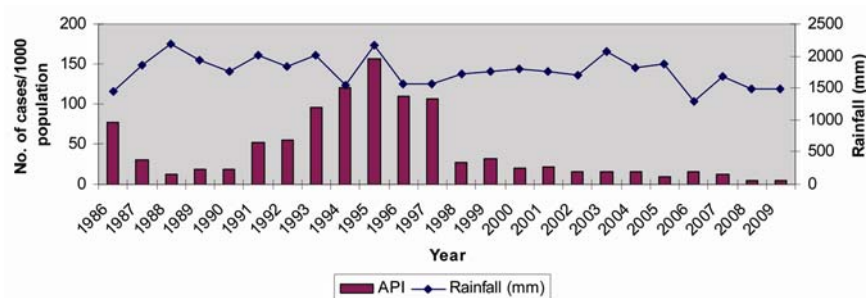
## El Niño and malaria transmission in northeast India

Akhtar<sup>1</sup> has presented empirical evidence for malaria outbreak in Thar desert due to high rainfall associated with the El Niño Southern Oscillation event that occurred in 1994. Based on the data for 1982–94, he observed positive correlation between rainfall conditions (total rainfall and number of rainy days) and incidence of malaria in 1983, 1990 and 1994, and suggested that annual rainfall of 500 mm or above may be taken as an indicator in forecasting malaria outbreak in Thar desert region of western Rajasthan.

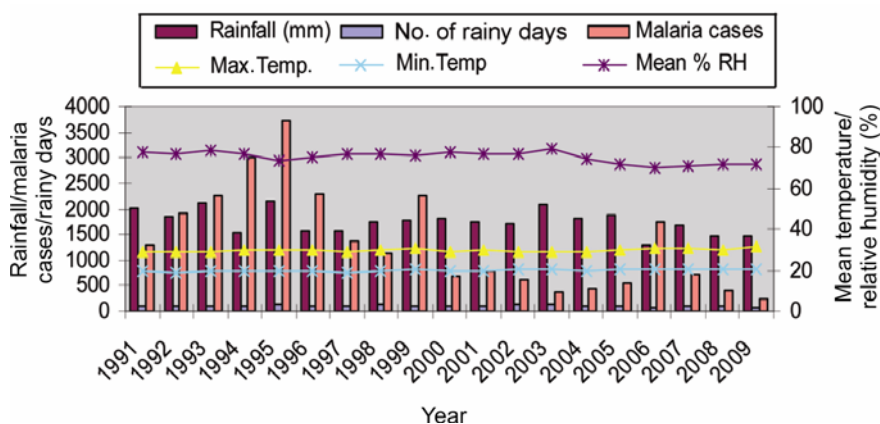
In contrast to desert conditions, northeast India (22–29°N, 89–97°E) is a tropical wetland ecosystem, and malaria is by far a major public health concern that only 3.96% of the population accounts for >10–12% of *Plasmodium falciparum* cases, and 20% deaths of those recorded in India annually<sup>2</sup>. The annual rainfall associated with southwest monsoons in the northeast is one of the heaviest in the world. The rainy season in this part of the country is an extended one spanning over 6 months of the year (April–September). However, the extent of annual rainfall is reportedly variable between years and places across its landscape. The fauna and flora is rich, and more than 40% of the total land area is covered with evergreen tropical rain forest.

Here, we present empirical evidence that in the wetland ecosystem nothing can be ascribed to meteorological factors that relate to inter-annual variation in

malaria transmission intensities at the local level (Figures 1 and 2). For data based on the Sonapur Primary Health Centre of Kamrup district (a typical



**Figure 1.** Rainfall and malaria transmission in the Sonapur Primary Health Centre (Dimoria block), Kamrup district, Assam, India (source: State Health Services of Assam).



**Figure 2.** Mean annual rainfall, number of rainy days, mean annual maximum and minimum temperature (°C), annual mean relative humidity (%) and malaria cases in the Sonapur Primary Health Centre (Dimoria block), Kamrup district, Assam, India for data based on passive surveillance.

malaria endemic foothill area of Assam), a retrospective analysis revealed that correlation between annualized rainfall and number of confirmed cases of malaria per thousand population year for the study period (1986–2009) was too far weak to be statistically significant ( $r = 0.070$ ;  $df = 22$ ;  $P = 0.750$ ). Similarly correlation between annual number of rainy days and malaria cases for the period (1991–2009) was also not statistically significant ( $r = 0.223$ ;  $df = 17$ ;  $P = 0.359$ ).

The rise in temperatures, however, was observed to be critical for build up of mosquito vector density of *Anopheles minimus*, and onset of transmission of *Plasmodium falciparum* malaria. Monthly distribution of cases revealed that malaria was prevalent throughout the year but there were consistently far more cases of *P. falciparum* during months of high rainfall (April–September) that were significantly correlated with maximum temperatures ( $r = 0.997$ ;  $df = 2$ ;  $P = 0.003$ ). But similar to observation of Akhtar<sup>1</sup>, correlations between mean annualized maximum temperature and malaria cases ( $r = -0.126$ ;  $df = 17$ ;  $P = 0.607$ ) for the years (1991–2009) were insignificant.

From the presented data in the given study area, it was apparent that irrespective of the rainfall, even though the disease transmission levels were variable but for the past decade, the transmission trends were clearly declining during which newer interventions based on insecticide-treated nets for vector control, and upgraded drug policy for treatment of drug-resistant cases were incorporated in healthcare services. Similar observations were reported from rain-fed forest related malaria transmission in central India<sup>3</sup>. Thus, unlike dry zones of India, it was revealed that rainfall data alone is not a sufficient indicator for early warning system in the wetland ecosystem, and the long-term malaria control strategy should rely on generation of increased awareness on disease and prevention, focused interventions, healthcare access, and national commitment for increased prosperity, particularly in resource-poor settings.

Similar conclusions were drawn in East Africa where no significant associations were observed in long-term meteorological trends and local malaria resurgences<sup>4</sup>. More often human activities (non-climatic factors) have led to increased mosquito breeding, poverty

and physiographic risk factors<sup>5,6</sup>. In present times, we advocate that the understanding of local disease epidemiology and community based interventions such as bioenvironmental approaches and the use of insecticide-treated mosquito nets are important to formulate interventions that are community-based, operationally feasible and sustainable for averting impending disease outbreaks.

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## Jhumming, a traditional lifestyle than merely a cultivation method

The traditional slash-and-burn cultivation in hilly areas of northeast India is known as *jhum* cultivation. It is often considered responsible for causing soil erosion, triggering landslide, flash floods and thereby degrading the primary land resource. The productivity is also reported to be very low. Further, it is also held responsible for causing forest fire, depletion of forest resource and degrading the environment. Earlier the *jhum* cycle was about 20–30 years, however, growing human population and increasing anthropogenic pressure on land has reduced the cycle to 2–3 years, thus resulting in the degradation of the ecology and environment of the hilly region<sup>1</sup>. The neglected ember escaping from burning *jhum* transforms the forest cover into ashes. Forest depletion and forest burning also pushes certain important species to extreme limits of extinction.

The various ethnic communities of biodiversity-rich Arunachal Pradesh are practising this system since time immemorial. With 81.22% area under forest cover, Arunachal Pradesh has the potentiality to serve as a treasure trove of germplasm for food plants, medicinal plants, bamboo and cane, orchids, wild animal species and other life forms<sup>2</sup>. However, the rate of forest cover decrease is high in the state, with about 26 km<sup>2</sup> area of forest decreasing between 2001 and 2003 (ref. 3). The main threat for loss of 'green treasure' undoubtedly stems out from *jhum* and forest burning.

Despite all odds, *jhumming* enjoys a pivotal position in the tribal societies of hilly northeast India. This strongly confirms that the system is deeply rooted in tradition, culture, beliefs, festivals, legends and myths. The folk songs *eme laamayo eme* and *ojo tojo maaya* of Galo

tribes depict different stages of *jhumming*. Abotani, the legendary ancestor of Tani Group, is believed to have been taught *jhumming* techniques by Goddess 'Mopin'. Moreover, *jhum* provides varieties of food items preferred by the tribal people throughout the growing season. The mixed crops raised in *jhum*-field



*Jhum* cultivation (Daring, West Siang, Arunachal Pradesh).