

Helping communities control *leishmaniasis* in rural Tunisia

As climate change and irrigation pressures mount in rural Tunisia, a multi-faceted research effort is giving rural communities the knowledge and tools to stem a growing tide of infection.

Ecohealth approaches to controlling *leishmaniasis*

- Limit nighttime irrigation to reduce contact with sandflies.
- Improve water management and irrigation systems to limit soil saturation and conserve moisture.
- Monitor temperatures, rainfall, sand rat populations, and vegetative cover for early warning signs.
- Keep livestock, waste, and manure away from households.

Zoonotic cutaneous *leishmaniasis* (ZCL) is on the move. This scarring, vector-borne disease has emerged as a major public health problem in Tunisia, as land use, water management practices, and climate change create conditions ripe for its spread. With more than 90% of its territory at risk of desertification, Tunisia's agricultural production is almost entirely irrigated. The country's already scarce water resources are increasingly threatened by climate change: more frequent and prolonged droughts are projected, with average temperatures to rise 2.1°C by 2050.

Irrigation creates ideal breeding conditions for the sandfly vector (*Phlebotomus papatasi*) which transmits the disease, and for sand rats (*Psammomys obsesus* and *Meriones shawi*), which serve as a reservoir host for the parasite that causes ZCL. And with agricultural settlements spreading into areas that had been pastoral, new populations with no immunity to the disease are exposed.

As of 2006, ZCL was endemic in 15 of 24 Tunisian governorates. More than 7,000 cases are reported yearly, mainly from Kairouan, Gafsa, and Sidi Bouzid. Recently, ZCL cases have also appeared in more temperate regions of Europe.

Within weeks or months of a bite by an infected sandfly, raised sores appear on the skin, and may eventually ulcerate to form unsightly scabs. Though the disease is relatively painless, it can be cruelly disfiguring. Women in particular suffer a heavy social and psychological burden from its stigmatizing effects.



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Women scarred by cutaneous *leishmaniasis* feel stigmatized by the disease.

There is no vaccine or effective treatment for ZCL, and control efforts have been reactive, focusing on outbreaks already underway. The challenge of controlling this disease has been exacerbated by the limited health infrastructure in rural areas

The research: fine-tuning an ecological early-warning system

Since 2009, a multidisciplinary research team has been working with local communities in the governorate of Sidi Bouzid to better understand the underlying factors favouring the spread of ZCL, and to identify practical measures to prevent transmission.

In a first phase of research, the team investigated the interactions between climate trends, socio-economic factors, local farming practices, and the ecology of vector and host species. It also explored, for the first time, the disease's social and psychological impacts on women. Researchers found that even where communities are supportive, female victims experience a profound sense of worthlessness and isolation due to the scarring.

Bioclimatic analysis showed that the overlap between the hot and rainy seasons is increasing, creating longer stretches of warm, humid weather that favour ZCL transmission. In working with the regional farmers union, researchers were able to identify how composting and irrigation practices—particularly overnight watering—were increasing farmers' exposure to sandfly bites.

To lay the groundwork for an early-warning system, the team began monitoring local vegetation and climate conditions, creating a continuous database that could alert the community to disease outbreaks. Because the ZCL transmission cycle involves both sandfly and rodent populations, warnings can be based on spikes in weather conditions favourable to sandflies, and the expansion of vegetative groundcover that nourishes local sand rats that host the parasite.

Building on earlier findings, the team is now focusing on community-led interventions to reduce the risk of infection. Water management and irrigation practices are being adapted to limit exposure to the disease. Farmers are encouraged to avoid overnight irrigation, limit soil saturation and water loss, and repair faulty equipment. These measures not only reduce health risk, but help intensify agricultural production through more efficient irrigation. In addition, households are creating healthier communities by keeping domestic animals, manure, and garbage away from their homes.

Results: a collaborative approach to reducing risk

With a new understanding of the factors driving disease transmission, researchers are working closely with farmers and community groups on adapting household behaviours, agricultural practices, and irrigation systems. They are also validating the model for an early-warning system. Above-normal winter temperatures and rainfall seem to be the most significant signs of increased risk of an outbreak the following summer.

Project findings are being integrated into local policy and practice through affiliation with the Tunisian Ministry of Health and engagement with the regional farmers union, agricultural development actors, and the Regional Health Directorate. Community members are actively involved in prevention, through a community-based NGO established in 2013.



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In Tunisia's arid conditions, agriculture depends heavily on irrigation, which can create prime conditions for *leishmaniasis*.

Besides benefiting some 26,000 inhabitants from seven villages in the study area, the project is positioned to contribute to national policy guidelines for *leishmaniasis* control in Tunisia. And its lessons may apply across North Africa and beyond, where agriculture, outmoded irrigation practices, and climate change similarly favour the spread of ZCL.

Phases 1 and 2 of the project "Community control of emerging leishmaniasis in the context of climate change in Tunisia" were funded by the International Development Research Centre through the Ecosystems and Human Health program. Since 1996, IDRC has supported multidisciplinary research that looks at the interactions between ecosystems, social dynamics and human health.

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