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Geospatial datasets and analyses for an environmental approach to African trypanosomiasis

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Geospatial datasets and analyses for an environmental approach to African trypanosomiasis

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EXECUTIVE SUMMARY

Human and animal trypanosomiasis continue to contribute substantially to the overall burden of diseases in sub-Saharan Africa, thus posing a serious hindrance to food security and sustainable rural development in many regions that are infested by the tsetse fly, the vector of the disease.

A number of current initiatives are being used to tackle different aspects of the tsetse and trypanosomiasis (T&T) problem. Multinational projects based on the concept of area-wide integrated pest management (AW-IPM) are being implemented in many affected countries with, for some of the projects, the concurrence of the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) initiative. Extensive surveillance and control activities directed against the human form of the disease (also known as sleeping sickness) are carried out by mandated national institutions in collaboration with the World Health Organization (WHO).

A number of research institutes and nongovernmental organizations are also working to curb the T&T problem through demand-driven research and health relief operations. In this context, the Programme Against African Trypanosomiasis (PAAT) plays a central role in setting harmonized criteria, defining guidelines and developing standardized tools and methodologies for strategic interventions and operational decision-making.

This PAAT Position Paper stems from the recognition that geographic information systems (GIS) are becoming increasingly important in all phases of the project cycle, from its initial conceptual elaboration to the final evaluation. The first section of the paper provides a review of state-of-the-art global geospatial datasets that are available in the public domain and that are deemed relevant to assist in T&T decision-making. The review embraces epidemiological and environmental data concerning African trypanosomiasis, the tsetse fly, wildlife, livestock, human populations, land cover, surface hydrology and wetlands, elevation, climate and agro-ecological zones. It also includes information on roads, protected areas, georeferenced named locations and satellite imagery. The global datasets described in this section are particularly relevant in light of the transboundary, multinational quality of the T&T problem. The second section investigates the relationship between low- and medium-resolution global datasets and high-resolution local data, using the Mouhoun river basin in Burkina Faso as its study area. The strengths and weaknesses of the different sources of data in the context of T&T decision-making are discussed. The third section presents how GIS, database management systems and image processing software can be used to plan

and implement baseline entomological data collection for a T&T elimination project in Burkina Faso, one of the countries involved in the PATTEC initiative. The final section describes how GIS can be combined with satellite-assisted navigation systems to enhance the execution of a tsetse elimination project, based on the application of the sequential aerosol technique, in the Okavango delta in Botswana. This project was executed in accordance with the AW-IPM approach, which addresses the management of the total insect pest population in a defined, well-demarcated area or region.

Although by no means exhaustive, the review and case studies presented here provide a representative cross section of the possible applications of geospatial datasets and GIS analysis techniques in support of T&T interventions. It is believed that ongoing and future projects against T&T will benefit from the experiences presented in this paper and that these experiences will lead ultimately to more coherent, harmonized and efficient actions.

Acronyms

AAT	animal African trypanosomiasis
ADC	American Digital Cartography inc.
ADT	apparent density per trap per day
AEZ	agro-ecological zones
Agro-MAPS	Global Spatial Database of Subnational Agricultural Land-Use Statistics
AMD	African Mammals Databank
ASCII	American Standard Code for Information Interchange
AW-IPM	area-wide integrated pest management
AWRD	African Water Resource Database
BIL	band interleaved by line
CIAT	Centro Internacional de Agricultura Tropical
CIESIN	Columbia University Center for International Earth Science Information Network
CRU	Climatic Research Unit of the University of East Anglia
DCW	Digital Chart of the World
DEM	digital elevation model
DSMW	Digital Soil Map of the World
DTED2	Digital Terrain Elevation Data Level 2
EROS	USGS Center for Earth Resources Observation and Science
ESA	European Space Agency
ESRI	Environmental Systems Research Institute
ETM+	Enhanced Thematic Mapper Plus
GIS	geographic information system
GLC2000	Global Land Cover database for the year 2000
GLCF	Global Land Cover Facility of the University of Maryland
GLCN	Global Land Cover Network
GLiPHA	Global Livestock Production and Health Atlas
GLW	Gridded Livestock of the World
GLWD	Global Lakes and Wetlands Database
GNS	GEOnet Names Server
GPS	Global Positioning System
GPW	Gridded Population of the World
GRUMP	Global Rural–Urban Mapping Project
GTopo30	Global Topographic 30 arc-second DEM database
HAT	human African trypanosomiasis
HydroSHEDS	Hydrological data and maps based on Shuttle Elevation Derivatives at multiple Scales
IFAD	International Fund for Agricultural Development
IIASA	International Institute for Applied Systems Analysis

IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
JRC	European Commission's Joint Research Centre
LCCS	Land Cover Classification System
LGP	Length of Growing Period
LOIL	Landsat Orthorectified Image Library
LUT	land utilization type
MERIS	Medium Resolution Imaging Spectrometer
MSS	Multispectral Scanner
NASA	National Aeronautics and Space Administration
NGA	United States National Geospatial-Intelligence Agency (formerly NIMA and DMA)
NR	FAO Natural Resources Management and Environment Department
ONC	Operational Navigation Charts
ORNL	Oak Ridge National Laboratory
PAAT	Programme Against African Trypanosomiasis
PAAT-IS	Programme Against African Trypanosomiasis Information System
PATTEC	Pan African Tsetse and Trypanosomiasis Eradication Campaign
RS	remote sensing
SAT	sequential aerosol technique
SPOT	Satellite Pour l'Observation de la Terre
SRTM	Shuttle Radar Topography Mission
SWBD	SRTM Water Body Data
T&T	tsetse and trypanosomiasis
TM	Thematic Mapper
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VPF	Vector Product Format
WCMC	World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WHO	World Health Organization
WRI	World Resources Institute