

## COMPANY PROFILE

### 1. General profile

**Avia-GIS** "Agriculture and Veterinary Information and Analysis" is a Belgian consultancy company founded in 2001 that specializes in the collection, processing and analysis of spatial information, and the development of space-time information systems (STIS) with particular reference to animal health and production, agriculture, public health and health-environment. Emphasis is put on vector-borne diseases, zoonoses and emerging diseases. The company focuses on the application of state of the art techniques that broaden the scope of conventional analyses and decision-making through the inclusion of geographical information systems (GIS), satellite imagery methodologies, data warehousing and custom software development.

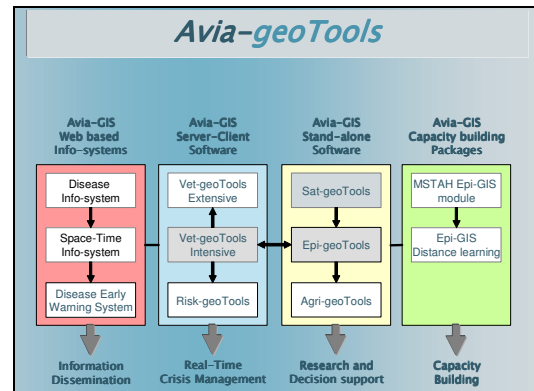


**Avia-GIS** aims at conducting research and technological development activities which contribute to the development of state of the art tools needed to achieve these objectives, including (i) spatial distribution models of vector borne diseases, (ii) vector population fragmentation analysis, (iii) disease spread and risk analysis, (iv) wind dispersal models applied to diseases. Obtained model outputs are embedded in spatial information systems for further epidemiological studies and decision support.

**Avia-GIS** operates as a spin-in company, offering state of the art inputs within its field of expertise to established academic and research teams. This is achieved as a

partner to joint RTD projects or through the establishment of broader fixed term RTD collaborations, enabling us to focus on applied research towards the development of efficient state of the art spatial tools.

**Avia-GIS** develops a commercial software package suite, Avia-geoTools, which will include a variety of spatial application tools in the field of expertise of the company. Currently focus is on the development of (1) Sat-geoTools for the use of low resolution remote sensing data in spatial epidemiology is already available, and (2) Vet-geoTools a spatial veterinary information system for the improved real-time management of disease outbreaks.



### 2. Permanent RTD Staff

**Guy Hendrickx**, DVM, Ph.D., was borne in 1960. He graduated as doctor in veterinary medicine in 1985 and has over 20 years of experience in the field of spatial epidemiology, livestock geography and decision support systems. Prior to founding Avia-GIS he completed a series of long-term assignments at increasing levels of responsibility first for VVOB in Rwanda and then for FAO in Tanzania, Togo and Burkina Faso where he conducted both research and development activities. His main research activity was the development and implementation of country wide Geographical Information Systems (GIS) applied to integrated vector borne disease control. In 1997 he was laureate of the National Academy of Overseas Sciences (Brussels, Belgium) with a dissertation on this topic. In 1999 he obtained his PhD on the design of a georeferenced decision support methodology towards

trypanosomosis management in West Africa. This work included the use of remote sensing to model vector, pathogen and disease distribution and abundance/prevalence, and the use of documented decision support trees in GIS. Obtained results allowed gaining novel insights on the spatial epidemiology of trypanosomosis and its impact on the integration of livestock and crop-agriculture. As project manager and chief technical advisor he was leading multidisciplinary teams involved with technology transfer, training and extension work. Particular emphasis was given to the role of private rural veterinary practitioners as a key element towards sustainable disease management. Since 2000, back from Africa, he is founding managing director of Avia-GIS.

**Els Ducheyne**, MSc, Ph.D., was borne in 1976. She graduated as doctor in agricultural and applied biological sciences, option land- and forest management in 2003, and has over 5 years of experience in the domains of remote sensing, geographic information systems, forest management decision support systems and artificial intelligence. During her PhD she investigated the potentials of genetic algorithms in combination with geographic information systems for forest management optimization. The combination of these two techniques made a truly spatial decision support tool possible for forest management optimization because the optimization procedure could communicate directly with the GIS. During this period, she became adept at working with several GIS/RS software packages such as Idrisi, ArcView, ArcGIS, Manifold, Grass and ERMapper as well as with programming in R, Java and Matlab. After her PhD, she has been working on a long term project from Avia-GIS in collaboration with the Institute of Tropical Medicine in Antwerp, where she focused on the applicability of low resolution remote sensing sensors (MODIS and NOAA) for modelling bluetongue, an emerging vector-borne disease in Europe. Currently, she is working as project manager at Avia-GIS. She is also member of the technical committee of the Conference on Evolutionary Computation (IEEE) and of the program committee of the Evolutionary Multicriteria Optimisation Conference.

**Els Goossens**, MSc, was borne in 1965. She graduated as an engineer in agricultural and applied biological sciences in 1988. After graduation, she worked for more than 5 years at the Laboratory of Remote Sensing and Forest Management at the University of Gent as a scientific collaborator. Her field of research was the use of remotely sensed data and GIS in several projects on desertification and land degradation in the dry tropics. The projects she worked out were conducted in close collaboration with several national and international institutions. During this period she gained experience in the use of remote sensing data, (semi-)automatic image classification techniques, spatial modelling as well as in organizing field work missions to remote areas in several African countries. After leaving for a long-time stay in the Philippines, she joined the Flemish Agency for Geographical Information where she was working within the Research and Development Division. She became an expert in object-oriented image classification of high resolution data, worked on large, region-wide datasets and advised governmental agencies upon their spatial data acquisition and infrastructure. From Sept., 1st 2007, she joined the Avia-GIS team. Els was widowed to Koen and has two children: Rosa (1995) and Anton (1997).

**Bart de Groot**, bachelor, was born in 1982 in Amsterdam. He graduated as bachelor in Applied Computer Science (IT) in 2005. During his studies he worked as a trainee for I.F. Automatisering, a Dutch company that developed a customizable database product aimed at non-profit organizations. There he acquired 'real life' experience in developing database products, testing software, and dealing with customers. As a student he contributed in his final year to the development of a buffer module prototype for a veterinary epidemiological information system for Avia-GIS. This was also the basis for his thesis. He developed this web based prototype using MS .NET, SQL Server and a variety of other Microsoft technologies. Following this successful collaboration he was contracted by Avia-GIS as ICT specialist. In the company he is responsible for the development of custom database and web enabled software, extending existing

software products, and the maintenance of the IT infrastructure.

### 3. Selected projects

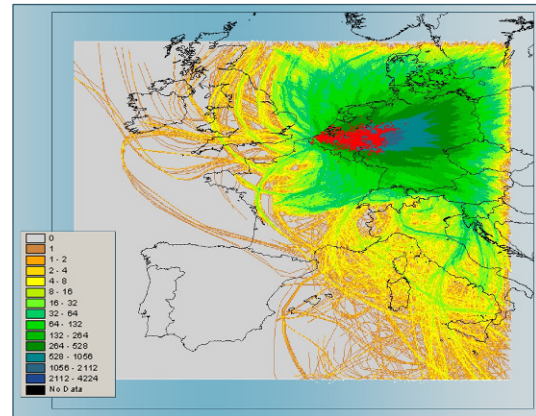
**V-borne** – Assessment of magnitude and importance of vector-borne diseases in Europe. Timeframe: 2007-2008. Funding Agency: ECDC. Executing Agency: Avia-GIS is part of a consortium of 16 partners conducting this six month study. Project Type: Short term RTD. Geographical keyword: Europe, Overseas Territories. General keyword: Vector borne diseases, Disease risk assessment, Priority identification, Action plan development. Specific keyword: Vector borne diseases, Emerging diseases.

**Epi-STIS** – Remote Sensing tools to study the EPidemiology and Space/Time dynamicS of diseases. Timeframe: 2007-2010. Funding Agency: Belspo. Executing agency: Avia-GIS is part of a consortium with 7 partners in charge of low resolution time series analysis and spatial modelling, windspread models, disease information systems. Project Type: Long Term Research and Development. Geographical keyword: Italy, Southern Africa. General keyword: STIS, Spatial modelling, Interfaces, Decision support. Specific keyword: Bluetongue, *Culicoides sp.*, Food and Mouth Disease.



**MODIRISK** - Mosquito vectors of disease: spatial biodiversity, drivers of change, and risk. Timeframe: 2007-2010. Funding Agency: Belspo. Executing Agency: Avia-GIS is part of a consortium of 6 members in charge of spatial sample design, palm to web data entry and management, low

resolution time series analysis and spatial modelling, What-if scenario building. Project Type: Long Term Research. Geographical keyword: Belgium, The Netherlands, Benelux. General keyword: Spatial modelling, Low Resolution Remote Sensing, Vectors of disease, Emerging Diseases. Specific keyword: Mosquitoes, *Aedes albopictus*.



**BTv8-2006** – Epidemiological analysis of the 2006 bluetongue outbreak. Timeframe: (2006-2007) Funding Agency: FOD and EFSA. Executing Agency: Avia-GIS is part of three expert groups: Belgium, Belgium-Netherlands-Germany-France (BT51), and EFSA, in charge of developing windspread models of BTv8. Project Type: Short term consulting series. Geographical keyword: Belgium, France, Germany, Netherlands. General keyword: Spatial epidemiology, Risk management, Wind modelling. Specific keyword: Bluetongue, ECMWF, *Culicoides*.

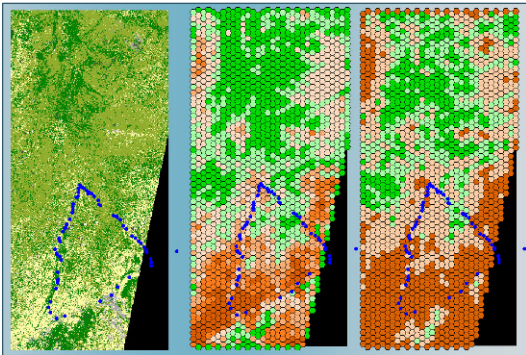
**GIS and Spatial Epidemiology Distance Learning Module** – Time frame (2007- ). Funding Agency: ITM. Executing Agency: Avia-GIS and ITM. As an add-on to the annual Epi-GIS module developed and given by Avia-GIS as part of the Masters course on Tropical Animal Health (MSTAH), the ITM awarded a subcontract to develop an additional distance learning module applicable to veterinary and public health.

**PARAGIS** – Spatial modelling of the impact of gastrointestinal parasites in Flanders. Timeframe: 2006-2007. Funding Agency: UGent. Executing Agency: Avia-GIS and UGent. Project Type: Short Term Research. Geographical keyword: Belgium, Flanders.

General keyword: Spatial modelling, Low Resolution Remote Sensing, Decision support. Specific keyword: *Fasciola hepatica*, *Dictyocaulus*, *Ostertagia*.

**BT-Calabria** – Factors affecting the distribution of *Culicoides imicola* in Calabria, Italy. Time-frame: 2006-2007. Funding Agency: Italian government. Executing Agency: Avia-GIS. Project Type: Long Term Research. Geographical keyword: Calabria, Italy. General keyword: Low Resolution Remote Sensing, High Resolution Remote Sensing, Spatial modelling, Vegetation patterns. Specific keyword: Bluetongue, *Culicoides imicola*, Wind modelling, Change detection.

**Vet-geoTools** – Spatial Veterinary Information System for the improved real-time management of disease outbreaks. Time-frame: 2005-2008. Funding Agency: Avia-GIS in-house project partially subsidized by IWT. Executing Agency: Avia-GIS and Eurotronics. Project type: Investment project. Geographical keyword: Belgium, Europe (and beyond). General keyword: STIS, Decision support. Specific keyword: Spatial epidemiology, Infectious diseases.

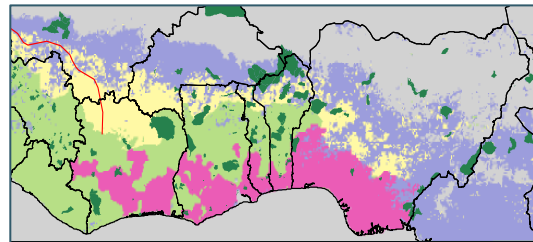


**FRAGFLY** – Environmental changes in Africa and tsetse habitat fragmentation: epidemiological consequences and perspectives for control. Time-frame: 2005-2007. Funding Agency: Wellcome Trust Fund (London, UK). Executing Agency: Avia-GIS is part of a consortium of 4 partners. Project Type: Long Term Research. Geographical Keyword: Western Africa, Southern Africa. General Keyword: High Resolution Remote Sensing, Vegetation pattern analysis, Decision

support, Vectors of Disease. Specific Keyword: African Animal Trypanosomiasis, Tsetse, Biotope fragmentation, Change detection.

**GMFS – Global Monitoring for Food security** – Time-frame: Stage 1 – 2004-2005, Stage 2 – 2005-2007. Funding Agency: European Space Agency (ESA, Frascati, Italy). Executing Agency: Avia-GIS is part of a consortium of 7 partners. Project Type: Long term Management and Service provider. Geographical Keyword: Africa. General Keyword: Operational management, Quality control, Food security, Livestock geography, Rangeland management. Specific keyword: Livestock distribution models, Carrying capacity.

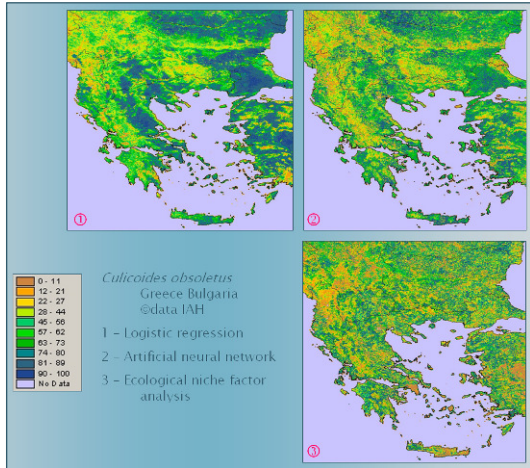
**EDEN – Emerging diseases in a changing European environment** – Time-frame: 2004-2009. Funding Agency: European Commission - FP6 (Brussels, Belgium). Executing Agency: Avia-GIS/Euro-AEGIS is part of a consortium of 49 partners. Avia-GIS is secretary of the Steering Committee in charge of operational management. Euro-AEGIS is in charge of spatial data management and disease information systems. Project Type: Long Term Management and Service provider. Geographical Keyword: Europe, Northern Africa, Western Africa. General Keyword: Operational management, Training, Data-management and Information systems. Specific Keyword: Emerging diseases, Environmental Change, Human health.



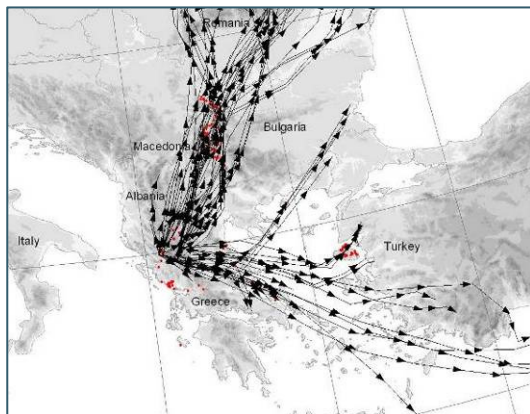
**MAPBEN** – Mapping the benefits: first steps in developing a new tool for tsetse and trypanosomiasis interventions. Time-frame: 2004. Funding Agency: Food and Agriculture Organization of the United Nations (FAO, Rome, Italy), UK Department for International Development (DFID, London, UK). Executing Agency: Avia-GIS is part of a consortium of 3 partners. Project

Type: Consulting Series R&D. Geographical Keyword: Western Africa. General Keyword: Decision support, Livestock geography, GIS, Remote sensing.

Specific Keyword: African Animal Trypanosomiasis, Livestock production systems, Trypanotolerant breed map, Cost-benefit of control.

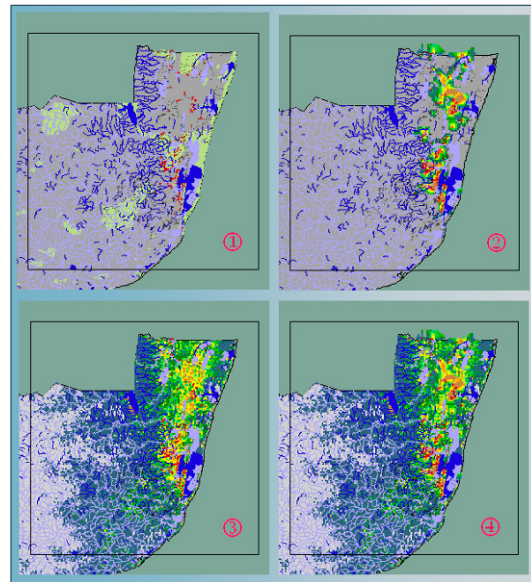


**BLUETONGUE** – Remote sensing and risk assessment of vector transmitted diseases: Bluetongue. Time-frame: 2003-2006. Funding Agency: Belgian Science Policy Office (Belspo, Brussels, Belgium). Executing Agency: Avia-GIS and ITM. Project Type: Long Term Research, partnership research-industry. Geographical Keyword: Mediterranean, Greece, Bulgaria, Europe. General Keyword: Disease modeling, Remote sensing. Specific Keyword: Bluetongue, *Culicoides imicola*, Wind modeling, Risk analysis.



**ECFRisk** – GIS analysis of East Coast fever risk in smallholder dairy production systems

in Kenya. Time-frame: 2003-2004. Funding Agency: International Livestock Research Institute (ILRI, Nairobi, Kenya) - International Fund for Agricultural Development (IFAD, Rome, Italy). Executing Agency: Avia-GIS and ILRI. Project Type: Consulting Series R&D. Geographical Keyword: Kenya, Africa. General Keyword: Disease modeling, Remote sensing. Specific Keyword: Tick, *Ripicephalus appendiculatus*, East coast fever, Stepwise multivariate regression analysis, Risk assessment.



**TsetseRSA** – Tsetse presence-absence prediction model for *Glossina austeni* and *Glossina brevipalpis* in KwaZulu Natal – South Africa. Time-frame: 2002. Funding Agency International Atomic Energy Agency (IAEA, Vienna, Austria). Executing Agency: Avia-GIS and OVI. Project Type: Consulting R&D. Geographical Keyword: Republic of South Africa, Africa. General Keyword: Disease modeling, Remote sensing. Specific Keyword: Tsetse, *Glossina austeni*, *Glossina brevipalpis*, Geo-statistics, Stepwise multivariate regression analysis.

#### 4. Selected publications

Ducheyne E, Hendrickx G, De Deken R, 2005. Mapping of Bluetongue: an emerging disease in Europe, *Vlaams Diergeneeskundig Tijdschrift*, **74**: 117-124.

Ducheyne, E., De Deken, R., Bécu, S., Codina, B., Nomikou, K., Mangana-Vougiaki, O., Georgiev, G., Purse, B.V. and Hendrickx, G. (2007) Quantifying the dispersal of *Culicoides* species in Greece and Bulgaria by wind. *Geospatial Health*, **2**: 177-189.

Ducheyne, E., Gilbert, M., Staubach, C., Elbers, A., Mintiens, K., Gerbier, G. and Hendrickx, G., A wind density model to predict the spread of bluetongue. *Preventive Veterinary Medicine*, submitted.

Hendrickx G., Biesemans J. and De Deken R., 2004. The use of GIS in Veterinary Parasitology. In Durr, P.A and Gatrell A.C. (Eds), *GIS and Spatial analysis in Veterinary Science*. CABI Publishing, Wallingford, UK, 145-176.

Hendrickx G, de La Rocque S and Mattioli R, 2004. Towards long term tsetse and trypanosomosis management options in West Africa. *PAAT Technical and Scientific Series - 6*, Food and Agriculture Organisation of the United Nations, Rome, Italy. pp 57.

Hendrickx G, de La Rocque S, Reid R. and Wint W., 2001. Spatial trypanosomosis management. From Data-layers to Decision Making. *Trends in Parasitology*, **17**: 35-42.

Hendrickx G, Napala A, Slingenbergh J.H.W, De Deken R, Vercruysse J. and Rogers D.J., 2001. The Spatial Patterns of Trypanosomosis Predicted with the aid of Satellite Imagery, *Parasitology*, **120**: 121-134.

Hendrickx G, Napala A, Slingenbergh J.H.W, De Deken R. and Rogers D.J, 2001. A contribution towards simplifying area-wide tsetse surveys using medium resolution meteorological satellite data. *Bulletin of Entomological Research*, **91**: 333-345.

Hendrickx G, Nevill E, Biesemans J, Kappmeier-Green K, Van Camp N and Williams R, 2003. The Use of Geostatistics and Remote Sensing to Optimise Tsetse Field Survey Results. The example of Kwazulu Natal (RSA). Newsletter on Integrated Control of Pathogenic

Trypanosomes and their Vectors – ICPTV, **7**, 26-30.

Hendrickx, G. et Napala, A. (1999) Le contrôle de la trypanosomose « à la carte » : une approche intégrée basée sur un Système d'Information Géographique. *Académie Royale des Sciences d'Outre Mer, Bruxelles, Mémoires Classe Sciences Naturelles & Médicales, Série 8*, **24**(4), pp. 88.

Hendrickx, G., Napala, A., Dao, B., Batawui, D., Bastiaensen, P., De Deken, R., Vermeylen, A., Vercruysse, J. and Slingenbergh, J.H.W. (1999) The area-wide epidemiology of bovine trypanosomosis and its impact on mixed farming in subhumid West Africa; a case study in Togo. *Veterinary Parasitology*, **84**, 13-31.

Hendrickx, G., Napala, A., Dao, B., Batawui, D., De Deken, R., Vermeylen, A. and Slingenbergh, J.H.W. (1999) A systematic approach to area-wide tsetse distribution and abundance maps. *Bulletin of Entomological Research*, **89**, 231-244.

Hendrickx, G., Napala, A., Slingenbergh, J.H.W., De Deken, R., Vercruysse, J. and Rogers, D.J. (2000) The Spatial Patterns of Trypanosomosis Predicted with the aid of Satellite Imagery, *Parasitology*, **120**, 121-134.

Wint, W., Slingenbergh, J., Hendrickx, G. and Bourn, D. (2001) *Livestock Geography: New Perspectives on Global Resources*. Website and CD-Rom: <http://ergodd.zoo.ox.ac.uk/livat12/index.htm>.

Wint, W., Bourn, D., Hendrickx, G., Kruska, R. and Slingenbergh, J. (2002) *Livestock Mapping: Present and Future*. Chapter 2: Global Environmental Databases (Volume 2). International Society for Photogrammetry and Remote Sensing (ISPRS) Ed. R.Tateishi. 39-54.

## 5. International networks

Most of the objectives of *Avia-GIS* are achieved through networking and

collaborations. Therefore **Avia-GIS** established:

- A European Economic Interest Grouping, Euro-AEGIS, with ERGO, the Environmental Research Group Oxford, UK.
- Formal five year RTD collaboration agreements with the Faculty of Veterinary Medicine (UGent) and Diergezondheid Vlaanderen (DGZ).
- RTD partnerships with Research Centres through joint RTD projects at the national level with the Centre Wallon de Recherches Agronomiques (CRA-W), Gembloux, the Institute for Tropical Medicine (ITM), Antwerp, the Royal Belgian Institute of Natural Sciences (RBIN), Brussels, The University of Antwerp (UA), The University of Gent (UGent), the Université Catholique de Louvain (UCL), the Université Libre de Bruxelles (ULB), the Vlaamse Instelling voor Technologisch Onderzoek (VITO), and at the international level with the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France, the TALA Research Group Oxford, UK, the Istituto Zooprofilatico Sperimentale dell Abruzzo et del Molisa G. Caporale, Teramo, Italy, the University of Pretoria (UP), Onderstepoort, Republic of South Africa, and Wageningen University, The Netherlands.
- The BT51 research group with colleagues from Germany (FLI), The Netherlands (Lelystad), Belgium (VAR) and France (CIRAD) to promote research on the epidemiology of bluetongue north of Latitude 51°N.
- The EPISTIS research group with colleagues from Belgian Universities to promote the development and use of remote sensing tools in epidemiology in Belgium.

**Avia-GIS** is internationally recognized in its field of activity and its main clients include (in alphabetical order):

- The African Development Bank (ADB).
- Belgian Research Institutes: The Institute for Tropical Medicine (ITM), The University of Gent (UGent).

- Bilateral development programs: The UK Department for International Development (DFID).
- European Union and Agencies – The Sixth Framework Program (FP6), Brussels, Belgium, The European Space Agency (ESA), Frascati, Italy, The European Food Safety Agency (EFSA), Parma, Italy, The European Centre for Disease Control and Prevention (ECDC), Stockholm, Sweden.
- International Research Institutes: International Livestock Research Centre (ILRI), Nairobi, Kenya.
- National Research Institutes – The Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France, the Istituto Zooprofilatico Sperimentale dell Abruzzo et del Molisa G. Caporale, Teramo, Italy.
- UN agencies: The Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, The International Atomic Energy Agency (IAEA), Vienna, Austria, The World Health Organization (WHO), Geneva, Swiss.

Other research funding agencies include: the Wellcome Trust Fund, London, UK, the Belgian Federal Science Policy Office (Belspo), The Belgian Federal Ministry of Health (FOD-Volksgezondheid) and The Instituut voor de Aanmoediging van Innovatie door Wetenschap en Technologie in Vlaanderen (IWT).



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