IWMI Research in Southern Sri Lanka

Dr. Wim van der Hoek, IWMI

IWMI has worked in southern Sri Lanka since the mid 1980s. Most of the work was done in Kirindi Oya on a variety of irrigation performance, operational, and institutional issues, in collaboration with the Irrigation Department and the Department of Agriculture. In Uda Walawe similar studies analyzed the performance of the irrigation system in relation to organizational and institutional factors. Walawe was also one of the cases studies in a multi-country study on 'Irrigation Management for Crop Diversification in Rice-based Systems.' This work was finalized around 1993 but in 1997 there was a request from the Mahaweli Authority to assist in studies to conserve water and increase productivity. Some of the options are further crop diversification, drip irrigation for bananas, and the alternate wet and dry irrigation method of cultivating rice.

Changes in agricultural water management have important effects on the breeding of mosquito vectors of human disease, the need for agrochemical applications, and the availability of drinking water. There are, therefore, important human health implications of such changes in agricultural water management. One of the projects that are now being implemented by IWMI and its collaborating institutions is to integrate the priority public health issues in overall water management in the Uda Walawe river basin. This is a novel approach that will improve the understanding of causal linkages between water, agriculture, the environment and human health in agro-ecosystems, not only in the Uda Walawe basin but also in other intensive irrigation projects.

The hypothesis of the present research is that the operation of irrigation systems can be changed so as to achieve positive health impacts, with minimum impact on agricultural performance. More specifically it is hypothesized that the breeding of the mosquito vectors of human disease, the need for agrochemical inputs, and the availability of drinking water are directly influenced by changes in irrigation water management

One of the activities of the project is to use new technologies such as geographical information systems (GIS), global positioning system (GPS), and remotely sensed satellite imagery to map the availability of surface water, vegetation, land use patterns, and other factors important for malaria transmission. IWMI and the AMC are using the larger Uda Walawe area as a first location to develop a risk map for malaria. Once this has been tested and validated, it could be extended to other areas and even to the entire island. Such a risk map will make it possible to target priority areas with control activities. It can also be useful as a decision support tool in health impact assessments for water resources development projects, and as part of an early warning system for impending epidemics.

Powerpoint slides of the presentation:

IWMI involvement in Uda Walawe

- 1986-1993: Research on improvements in water management and crop diversification
- 1997: Request from MASL to assist in studies to conserve water and increase productivity

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Slide 1

Human health study

- Increase the productivity of water while reducing human health risks
- Develop a methodology for an integrated approach to agricultural water management in river basins
- Evaluate the impact of different water management regimes on:
  - vector mosquito breeding
  - availability of water for domestic use
  - need for agrochemicals

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Project Outline

Water Savings
MASL
IWMI

Multiple use	**Malaria**	**Pesticides**
IWMI	IWMI	IWMI
McGill	AMC	Sri Jayaw.

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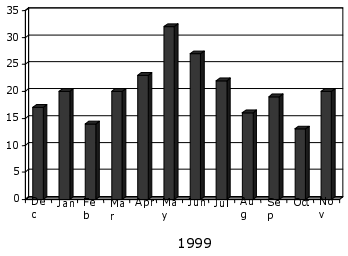
Slide 3

Admissions for pesticide poisoning in Embilipitiya Base Hospital



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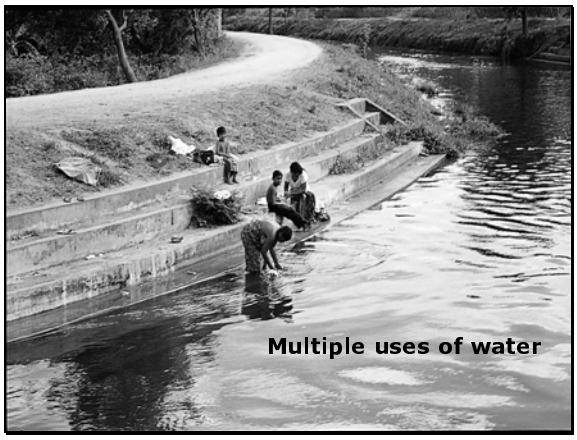

Slide 5

Drinking Water Sources

	Fecal contam.	F, salt, iron
Surface water	++	-
Deep wells	-	++
Shallow wells	±	±

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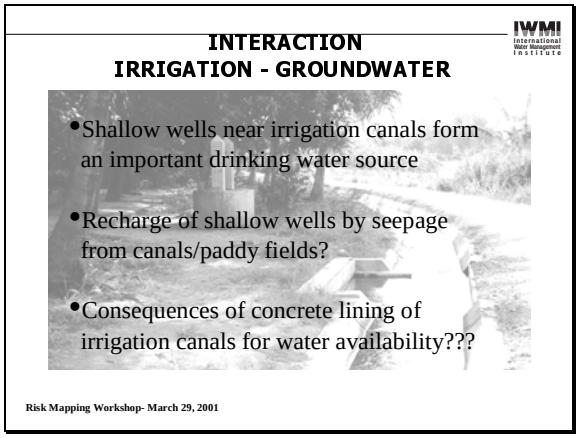
Slide 6



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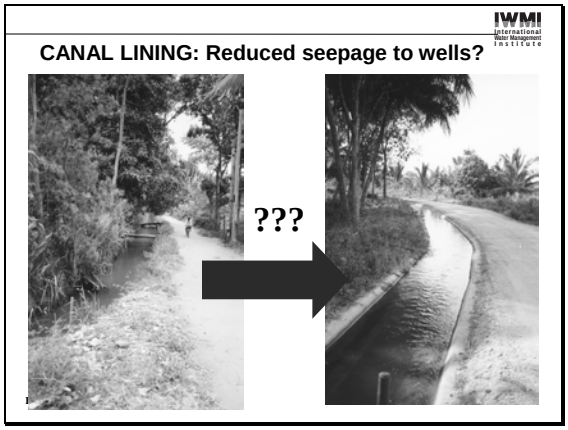

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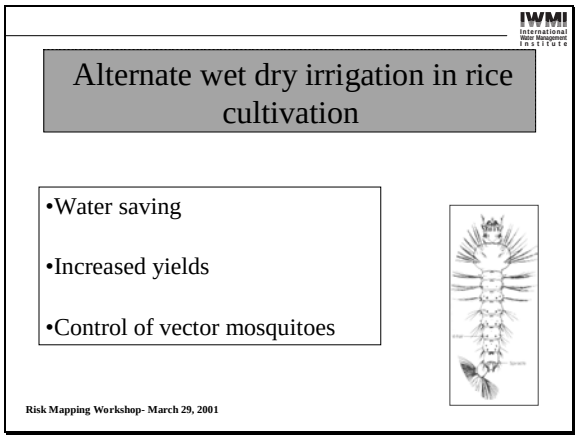

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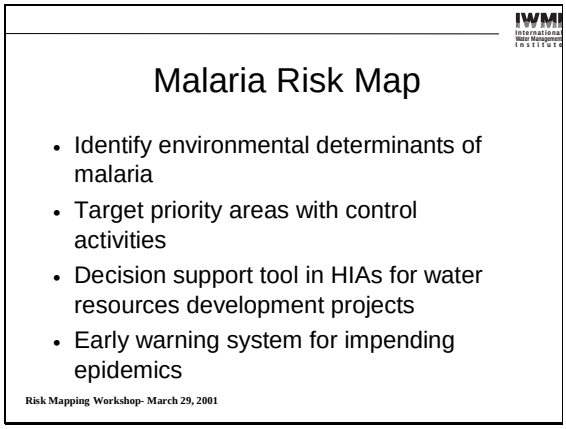

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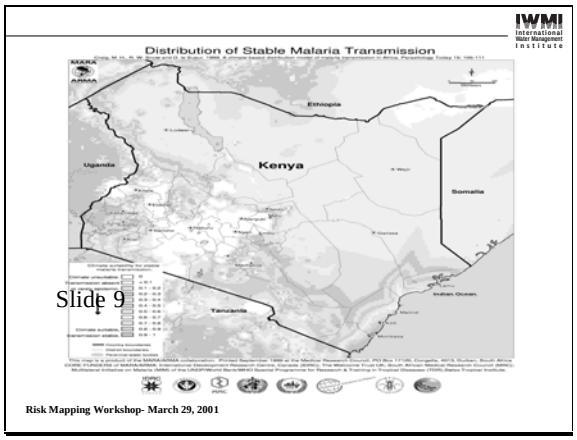

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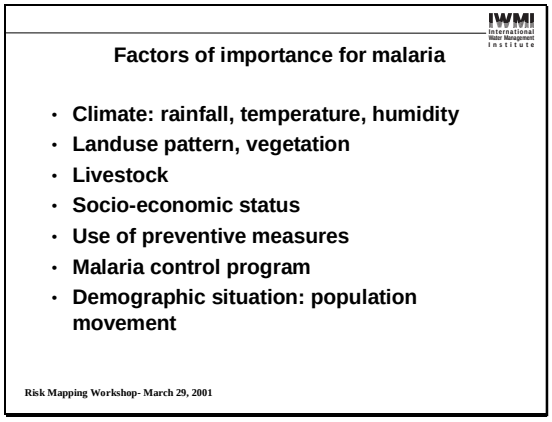

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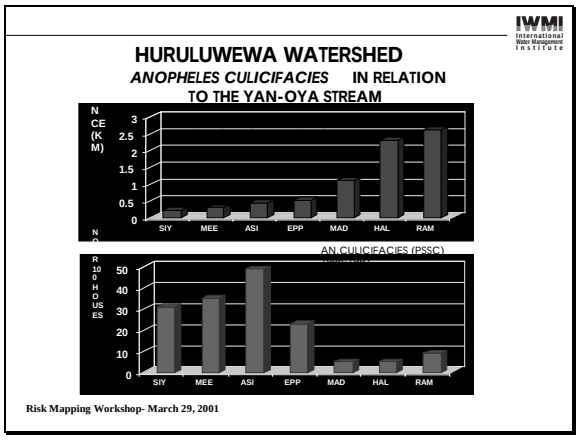

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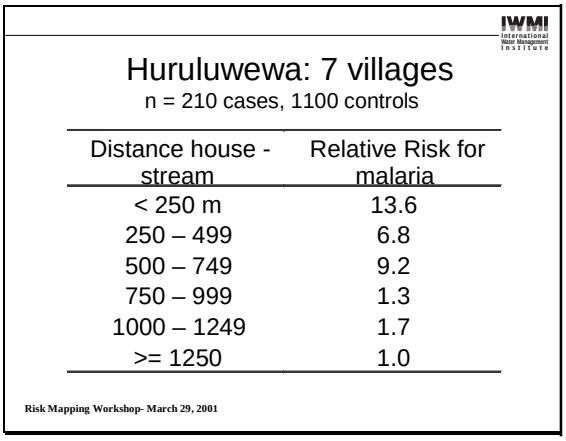
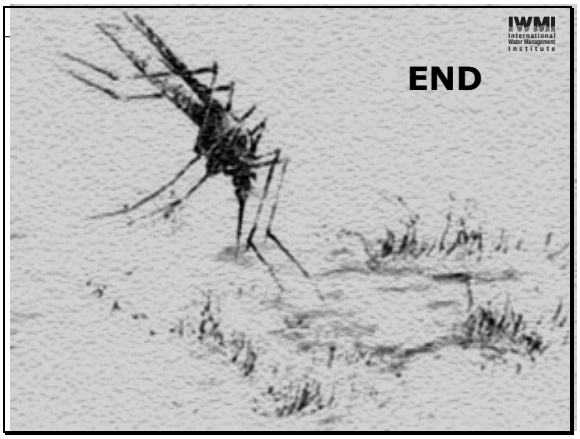


Distance house - stream	Relative Risk for malaria
< 250 m	13.6
250 – 499	6.8
500 – 749	9.2
750 – 999	1.3
1000 – 1249	1.7
>= 1250	1.0

Slide 14



Slide 15

Surveillance and Spatial Targeting of Malaria Control

D. M. Gunawardena and Lal Mutuwatta, IWMI

What is surveillance?

Surveillance "is the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation and evaluation of public health practices, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control (CDC)." Simply, surveillance is "data collection for action." In the surveillance mechanism it is important to have the data collected in a regular, frequent and timely manner, and orderly consolidation, evaluation and descriptive interpretation of data with prompt dissemination of findings.

Surveillance mechanisms of malaria control in Sri Lanka.

The national malaria control program in Sri Lanka has an elaborated surveillance system, which was originally established during the eradication era. This mainly consists of:

1. Epidemiological surveillance- Case data (Blood smears/ Pv/ Pf/ Sex/Age groups
2. Entomological surveillance- Vector data (Density, Biting rate/EIR/Resistance status)

The workshop on malaria surveillance held at the Family Health Bureau, Colombo 22-24 September 1999 for all regional malaria officers addresses the following matters:

Major issues discussed:

- Lack of staff for routine surveillance (Surveillance agents and diagnostic facilities)
- Slow flow of surveillance data (more than one month)
- Invalid malariometric index calculation (API and FR)
- Data not being optimally used for planning purposes (especially entomological data)
- Lack of feedback on surveillance data (Monthly reports or annual reports?)

Other issues discussed:

- Geographic unit (Village/GN)
- Frequency of reporting (Weekly/Monthly)
- Unequal distribution of surveillance (most of the facility available at town level)
- Availability of other relevant data (demographic data/housing/climate/land use)
- Additional data (treatment failure/severe and complicated cases/deaths/prophylaxis etc)
- Private sector case data (over 50% of malaria patients are reported from the private sector)
- Data collection format (deficiencies), new format necessary?

GIS and spatial targeting

The availability of advanced spatial analytical technologies such as Geographical Information Systems (GIS) and Remote Sensing are powerful tools that could be used in the decision making

process in malaria control. This technology will enable the study of the spatial and temporal distribution of malaria and its relationship with other parameters of malaria transmission. Simply, mapping functions of GIS could be used to identify and highlight risk areas and risk factors. In planning and implementing control activities this will assist in spatial targeting of control measures and in resource allocation. In monitoring and evaluation this will help identify where the control measures have not been successful.

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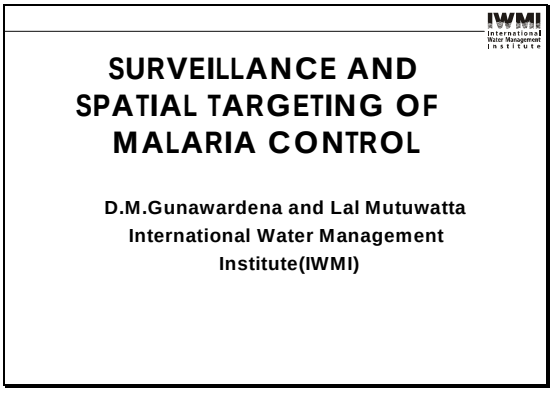

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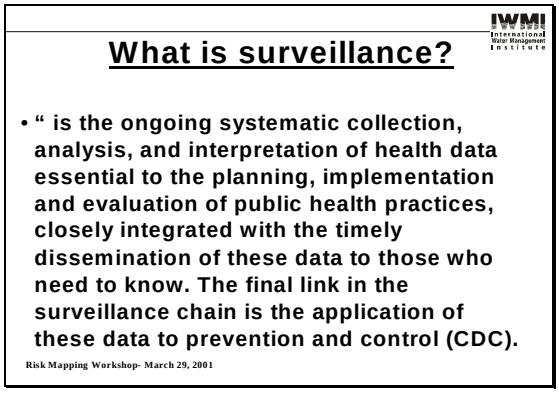

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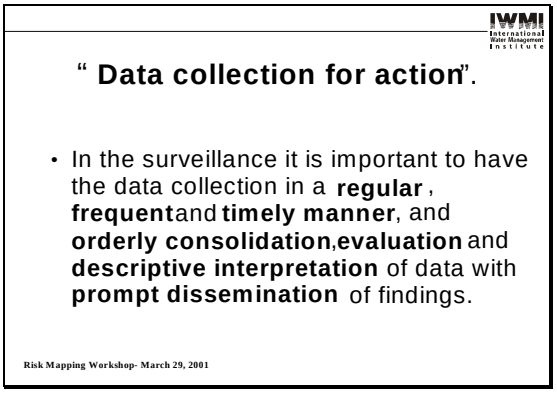

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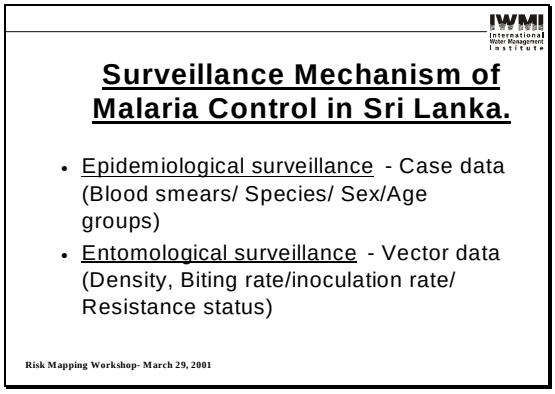

Slide 4

Matters discussed at the workshop on malaria surveillance
(FHB, Colombo 22-24 Sep 1999).

Major issues

1. **Lack of staff for routine surveillance (Surveillance agents/diagnostic facilities)**
2. **Slow flow of Surveillance data (more than one month)**
3. **Invalid malariometric indices calculation (API / % FR)**
4. **Data not being optimally used for planning purposes (especially entomological information).**
5. **Lack of feedback on surveillance data (Monthly report/annual report?)**

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Other issues discussed

- **Geographic Unit (Village/GN)**
- **Frequency of reporting (Weekly/Monthly)**
- **Unequal distribution of surveillance (most of the facility available at town level)**
- **Availability of other relevant data (demographic data/housing/climate/land use)**
- **Additional data (treatment failure/severe & complicated cases/deaths/prophylaxis etc)**
- **Private sector case data (over 50% of malaria patient from private sector)**
- **Data collection format (deficiencies) new?**

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Spatial analysis of malaria risk would be a useful tool for evidence based decision making

- in identifying risk areas and risk factors.
- in stratification for interventions
- use of limited resources in a cost-effective manner.
- Delay the emergence of resistance.

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Use of advance spatial analytical technologies in spatial targeting

- **GIS (Geographical Information System)**
- **RS (Remote Sensing)**

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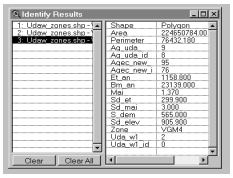
Slide 8

What is GIS?

A computer assisted information management system of geographically referenced data



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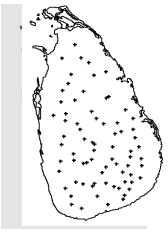
Annual precipitation (mm)
June 1999 to May 2000



Major Land Use types in Sri Lanka

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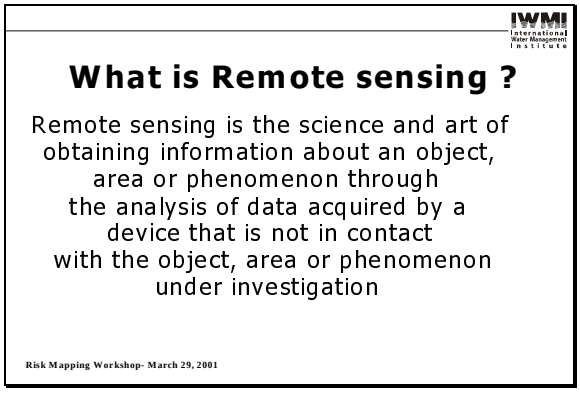

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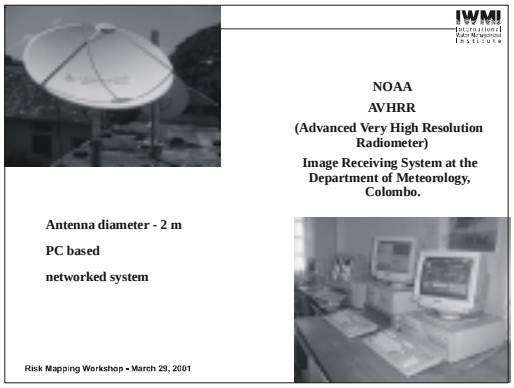

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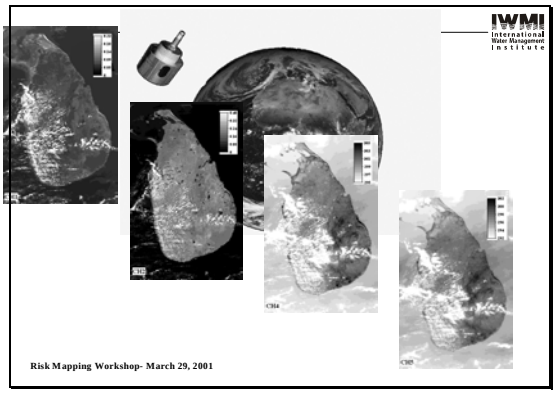

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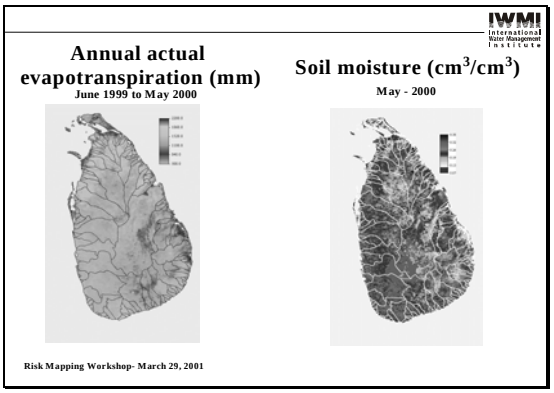

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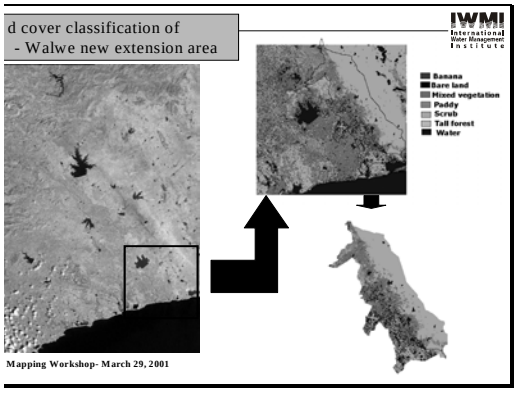


Slide 15

Towards a Risk Map for Southern Sri Lanka: Preliminary Results from the Uda Walawe Region

Eveline Klinkenberg, IWMI

Six Divisional Secretary Divisions (DSDs) from the Uda Walawe regions were selected: Embilipitiya, Thanamalvilla, Sevenagala, Angunukolapelessa, Ambalantota and Sooriyawewa. All confirmed malaria cases reported to the government health facilities within these 6 DSDs (see Figure 2) were collected for the period January 1991-August 2000. Additionally, data was collected from health facilities just outside the 6 DSDs to which the people from inside the 6 DSDs would go. Malaria data from private clinics were not available and therefore could not be included. As population data were in general only available per Grama Niladari area (GN), all data were up-scaled to GN level. For each GN the malaria incidence (number of cases per 1000 inhabitants) was calculated for each month for the period January 1991-August 2000. These malaria incidences were mapped using GIS software (ARCVIEW) (see Figure 3).

The malaria incidence pattern showed:

- an overall high incidence in the Thanamalvilla DSD throughout the years studied
- some GNs along the Ratnapura road with high incidences
- relatively low incidences in the rest of the area
- no clear seasonal pattern in malaria incidences over the years studied

A second step, which is still ongoing, is to correlate the found malaria incidence pattern to possible explaining factors. For this purpose, data for the following parameters have been collected so far: land use, presence of water bodies (rivers, streams, tanks), rainfall, socio-economic data (% of families receiving Janasaviya or food stamps, electricity supply, land and house ownership), control measures (spraying, use of bed-nets) and soil moisture data (from satellite images). Some parameters (land use, rainfall) are being processed with the aid of GIS software (ARCVIEW, ARCINFO) to obtain a value for each GN. The additional data needed are house construction data and entomological data as only limited data are available.

In general, it could be expected that in the irrigated areas malaria incidence is higher due to the almost continuous presence of water for mosquito breeding and that in the non-irrigated areas malaria is restricted to the rainy season this is not the case in the Uda Walawe region. Preliminary results reveal that there is a clear link between malaria incidence and land use. Malaria incidence is higher in the *chena* (slash and burn cultivation) areas and lower in the paddy and other crop and plantation areas. This could be related to the socio-economic status for which statistical analysis is ongoing or it could be related to the presence of additional breeding sources for mosquitoes in the *chena* areas. In the Uda Walawe area *chena* cultivation is most dominant in the Thanamalvilla DSD. Comparing the presence of water bodies in the high and low incidence areas revealed that the high risk area of Thanamalvilla contains a large number of abandoned tanks, while the rest of the area, with generally lower incidence contains several maintained tanks, but hardly any abandoned tanks. Therefore, it could be possible that these abandoned tanks form an important source of mosquito breeding, as they are not maintained. The importance of the abandoned tanks was investigated during a fieldtrip on the 28th of March 2001 the findings of which are summarized in chapter 7.

Figure 2. Location of hospitals in the Uda Walawe area from which data were collected to calculate the malaria incidence.

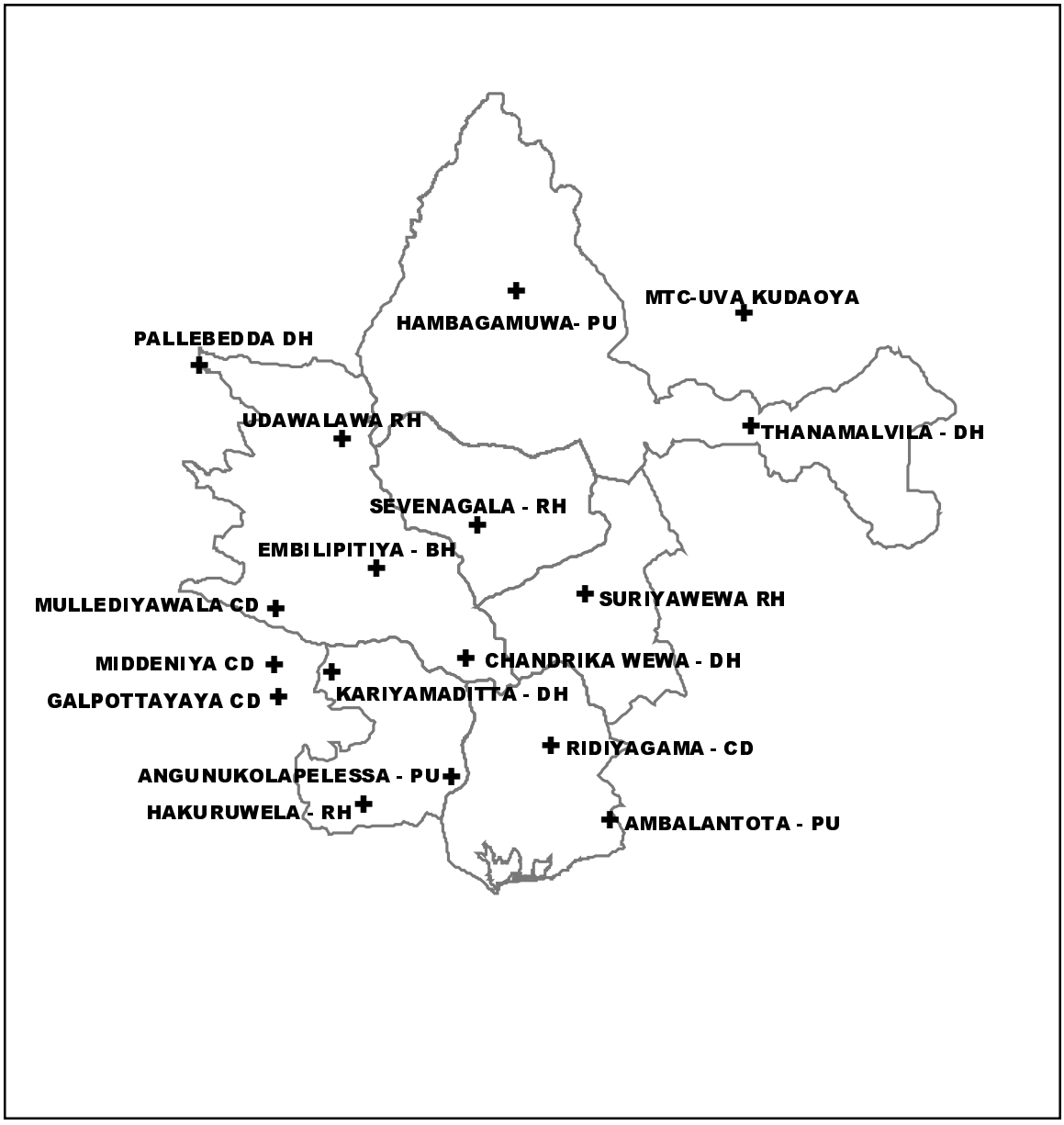
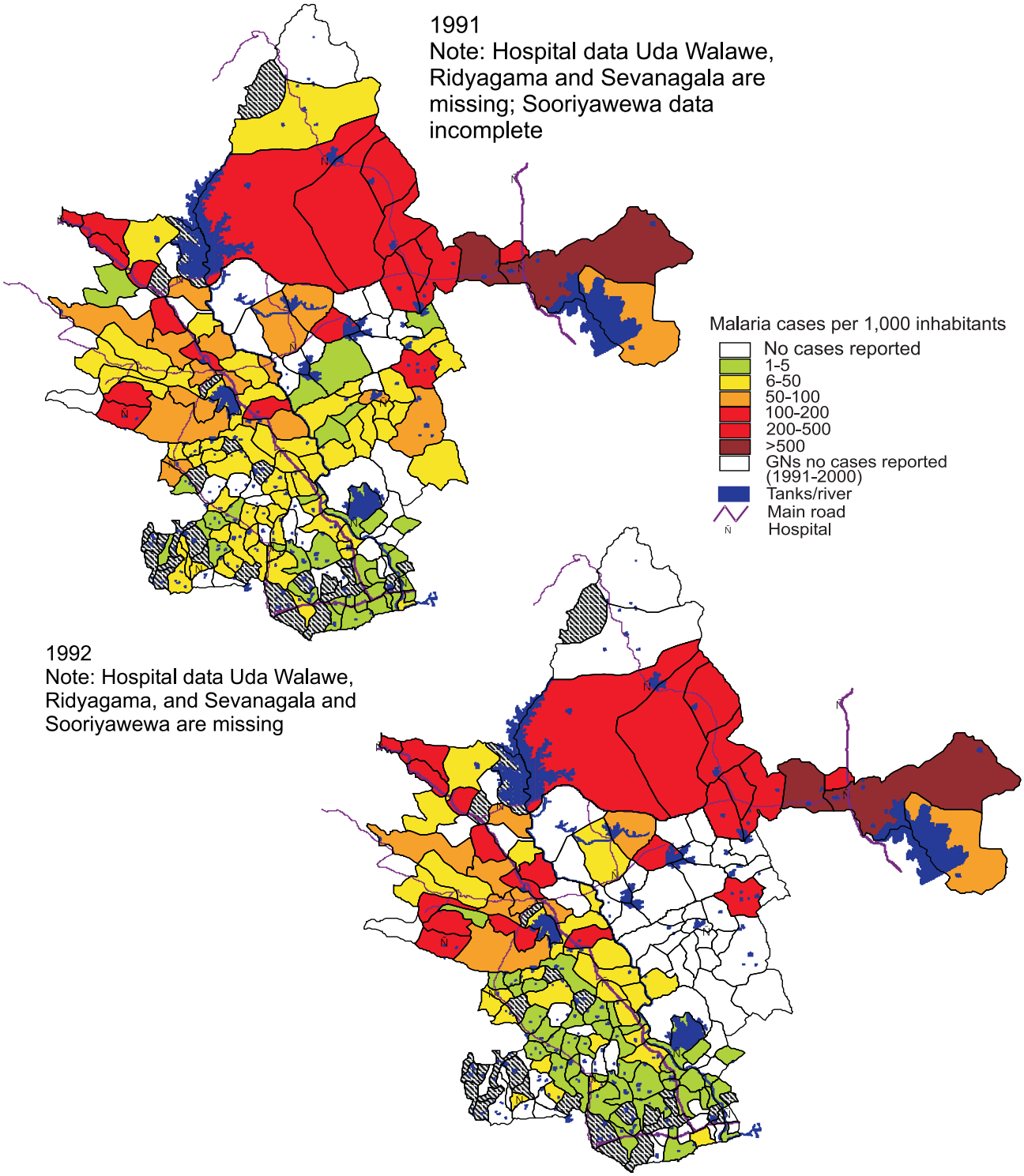
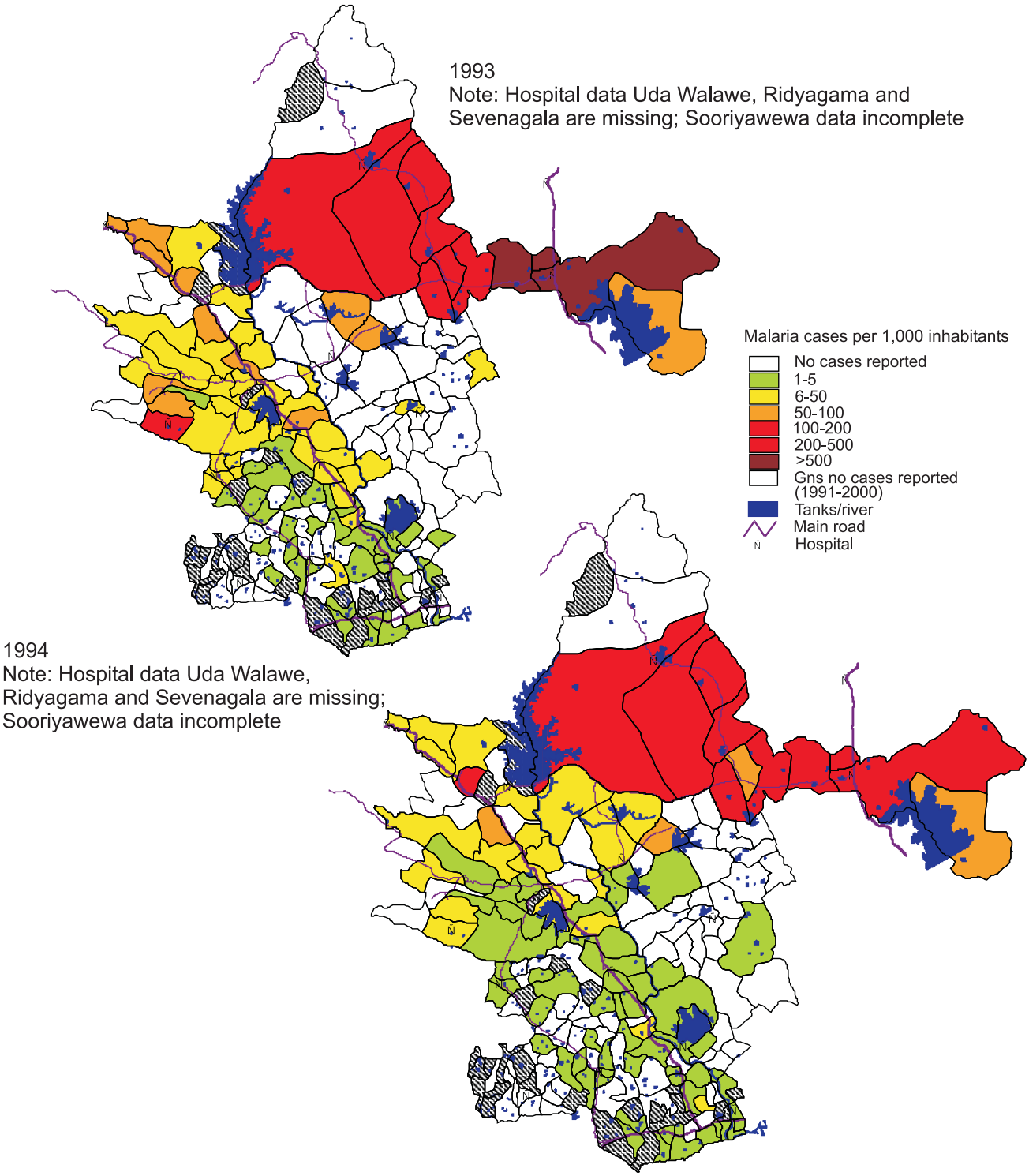
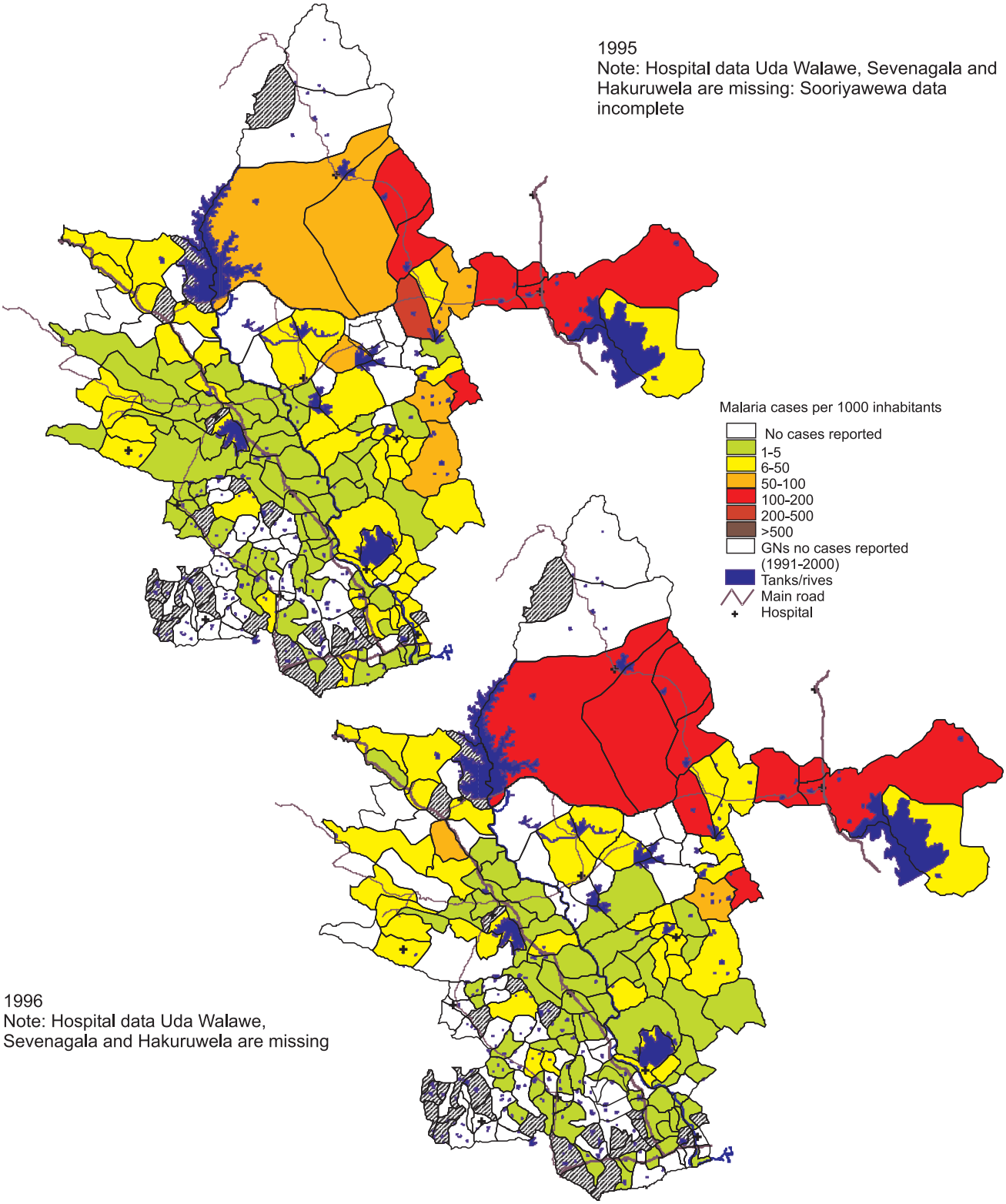


Figure 3. Malaria incidence maps for the Uda Walawe area for the period 1991-2000.




1993
Note: Hospital data Uda Walawe, Ridyagama and Sevenagala are missing; Sooriyawewa data incomplete
Malaria cases per 1,000 inhabitants
No cases reported
1-5
6-50
50-100
100-200
200-500
>500
Gns no cases reported (1991-2000)
Tanks/river
Main road
Hospital
1994
Note: Hospital data Uda Walawe, Ridyagama and Sevenagala are missing; Sooriyawewa data incomplete


1995
Note: Hospital data Uda Walawe, Sevenagala and Hakuruwela are missing: Sooriyawewa data incomplete
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