

# VECMAP workshop, RIVM

5<sup>th</sup> -7<sup>th</sup> January 2010



**Centre for  
Ecology & Hydrology**

NATURAL ENVIRONMENT RESEARCH COUNCIL

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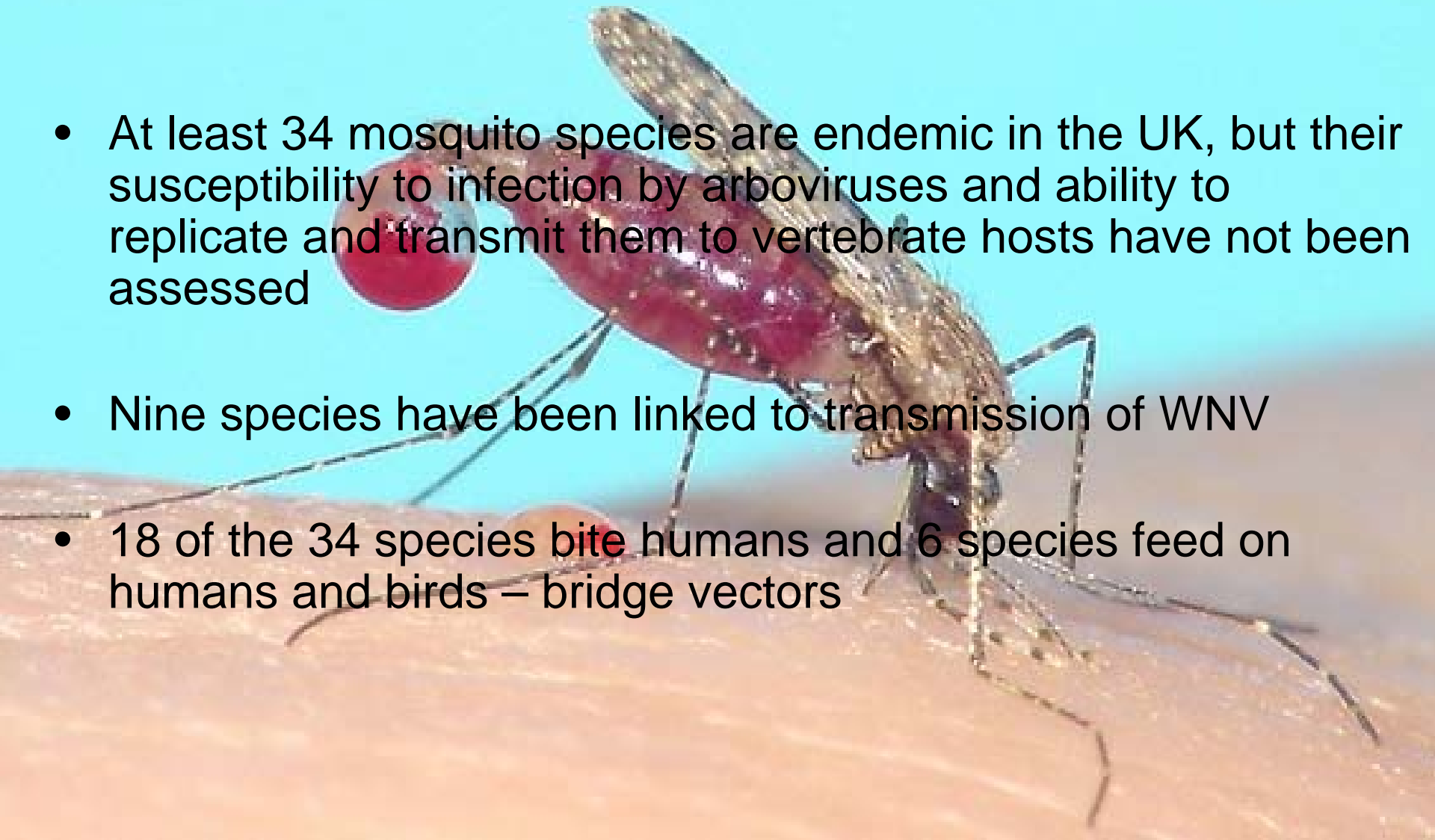
# EMMPOWER:

Evaluating and Managing Mosquitoes and Mosquito-borne Pathogens On Wetlands by integrating Ecology and Remote sensing



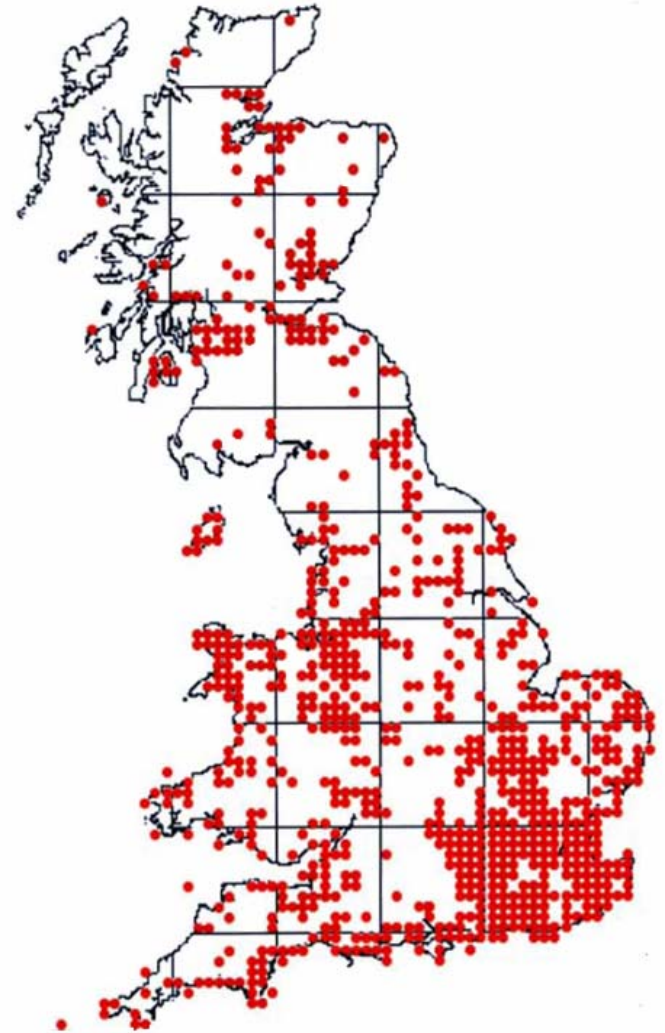
Environmental Change Integrating Fund project April 2009 -2012

# Vector potential of UK mosquitoes

- At least 34 mosquito species are endemic in the UK, but their susceptibility to infection by arboviruses and ability to replicate and transmit them to vertebrate hosts have not been assessed
  - Nine species have been linked to transmission of WNV
  - 18 of the 34 species bite humans and 6 species feed on humans and birds – bridge vectors
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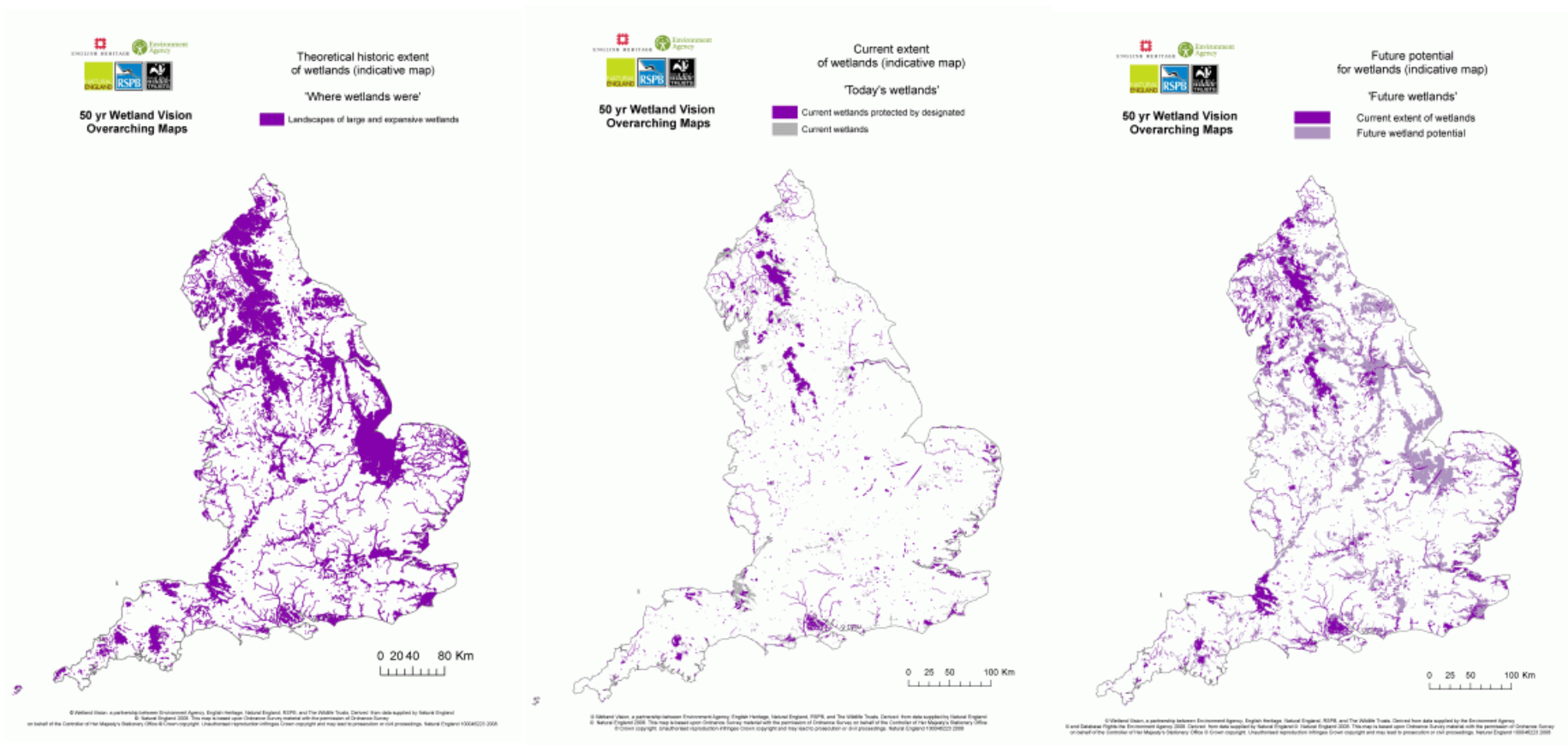
# Mosquitoes in the UK

- Sparse records of 34 UK mosquito species from 1901 to 1996.
- Mosquito Atlas data (*Snow, K.R., Rees, A.T. and Bulbeck S.J., 1997*) is currently being moved into an electronic gateway at the Biological Records Centre (BRC):



All mosquito species records

# A 50 year vision for wetlands



Past

Present

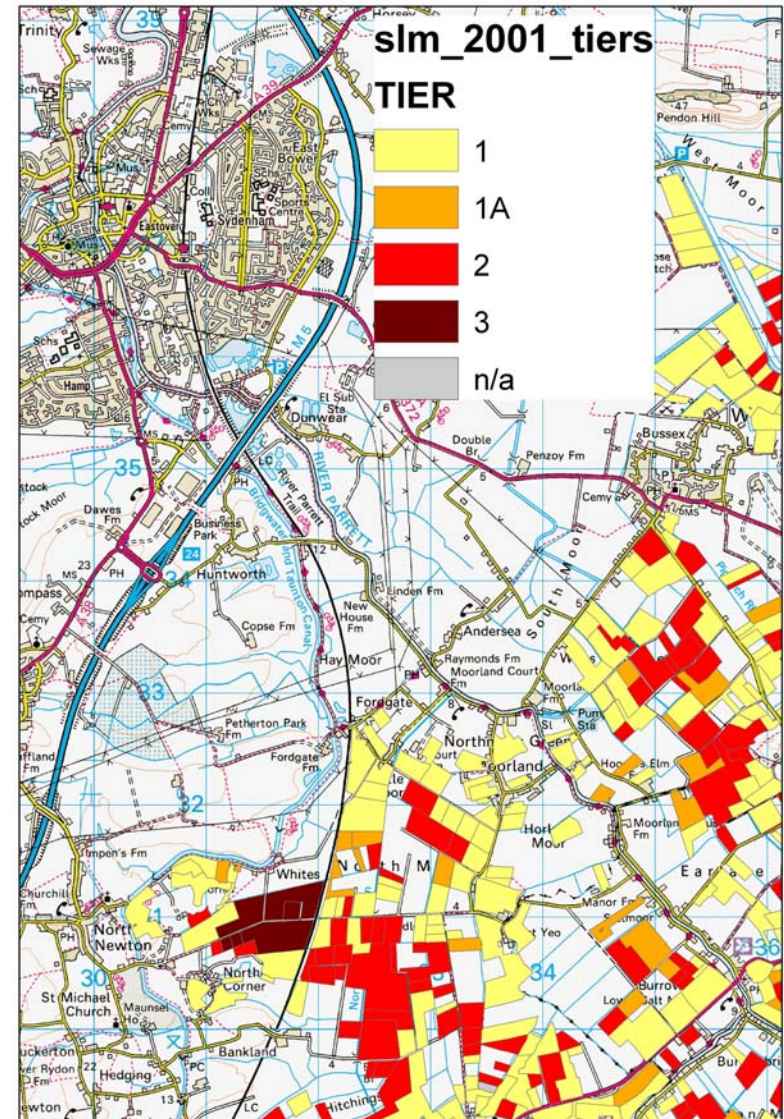
Future

# Aims of EMMPOWER

- Capacity building:
  - Training
  - Standardised methodologies to quantify mosquito abundance, barcode mosquitoes and detect vector-borne pathogens
  - Baseline data for mosquito species abundance, distribution, and biting preferences
- Develop an integrated approach to understand how climatic and land use change drivers interact at both local and regional scales to determine mosquito dynamics and their capacity for transmission of MBPs
- Use our understanding to predict mosquito species temporal abundance on British wetland at local and regional scales and relate this to mosquito-borne pathogen risk assessment and ultimately sustainable methods of control

# Test case: Somerset Levels & Moors

- UK lowland wet grassland currently undergoing changes in water level management and urban development
- Farmland managed for biodiversity within tiers - differing stocking densities, fertiliser and pesticide use, surface and ditch water levels
- Match static patterns in mosquito abundance across ~100 sites stratified by tiers, proximity to human population and climatic conditions



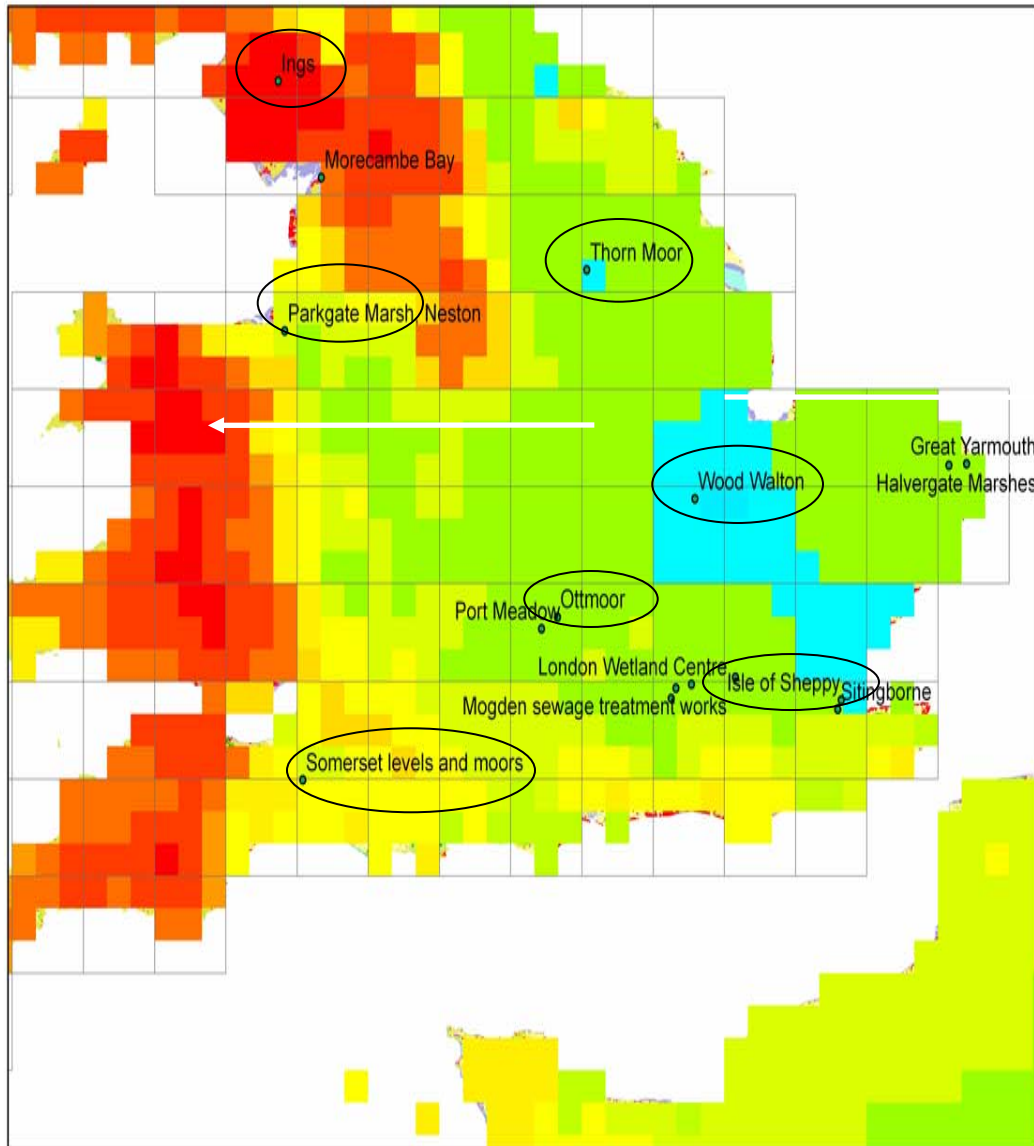
# Field methodology

- Stratified random (18 plots with 4 sites per plot and 2 water tier management regimes + urbanisation)
- CDC adult traps + dipping along transects
- Biological (vegetation and predators of mosquito larvae) and biophysical measurements of water characteristics
- GPS coordinates at each dip point accurate to  $\pm 1$  m.
- Digital photographs of each site
- Field data recorded on paper
- Landowner questionnaire





# Regional scale dynamics



- Establish weekly seasonal adult sampling on SLMs (10 traps) and 6 other wetlands in different climatic zones
- Start to identify key drivers of UK mosquito species by matching seasonal patterns in their dynamics with patterns in climate (temperature, rainfall and soil moisture levels) and hosts

# Can remotely sensed data help us explain and predict geographical and seasonal patterns in UK mosquito populations?

## *Low resolution remote sensing*

- Seasonal changes in key potential vector mosquito species will be recorded for 1-2 years along a latitudinal gradient and matched to equivalent changes in temperature and vegetation activity using 500m resolution MODIS data

## *High resolution remote sensing*

### LANDSAT and SPOT

- Imagery used to calculate fine-scale measures of land surface temperatures, vegetation indices, greenness and wetness
- Performance of these RS measures as predictors of mosquito distribution and abundance will be compared with ground-based habitat measures
- Evaluate whether land areas managed at different water tier levels differ in their seasonal, spectral responses

### RADAR

- Fine-scale mapping of moist soil and shallow water bodies used by mosquitoes for breeding
- PhD student, Nick Golding, supervised with Prof. David Rogers at Oxford University
- ENVISAT ASAR in Alternating polarisation mode imagery would be extremely useful

# Outputs relevant to MBP risk assessment in the UK

Qualitative estimates of impacts of climate and water level or flood plain management changes on mosquitoes and MBPs

e.g. Ranking of mosquito species and MBPs by their sensitivity to different types of environmental changes

Inputs to predictive models for MBDs in the UK

e.g. local scale maps of habitat and abundance for key vector mosquitoes

e.g. regional scale predictions of seasonality of key vector mosquitoes

Baseline population data for mosquito vectors against which to evaluate impacts of environmental changes and control measures

# CS and LCM

## **COUNTRYSIDE SURVEY (CS)**

- Ground based survey of vegetation, habitat type and freshwater undertaken by CEH every 5-10 years since 1974.
- 591 1km squares in England. Wales and Scotland surveyed in 2007
- Data recording in filed on GPS enabled tablet PCs with bespoke CS software

## **LANDCOVER MAP (LCM)**

- Derived from satellite data and ground truthing from CS survey
- LCM2007 resolution 0.5ha
- 71 habitat types defined
- Habitat Polygons overlaid on Ordnance Survey (OS) map

# Short term needs

- Robust handheld field device
- VECMAP user agreed SOPs for sampling mosquitoes
- Procedures and biological information on mosquito and MBP species (including distributions) downloaded to device
- Habitat types (RS layers) over-layed on OS maps
- Updates accessible remotely
- Map displays to orientate in direction of travel
- Minimal core data recording fields + 'flexible' (e.g. barcoding sequence data) fields.
- Database to include record of how sampling was performed to permit others to assess quality and whether suitable for estimates of abundance.
- Able to annotate maps and/or attach digital photos linked to individual records
- GPS enabled – as accurate as possible
- TOOLS TO HELP ESTIMATE VECTOR DENSITY V. HELPFUL