Precision **Crop Protection**
by Scarab Consult

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Using R to Reduce Pesticide Usage in the Horticultural Industry

Objective

Reduce costs, increase productivity and improve environmental conditions in the horticultural sector

Strategy

Provide a service to support timely and spatially-targeted pest and disease management
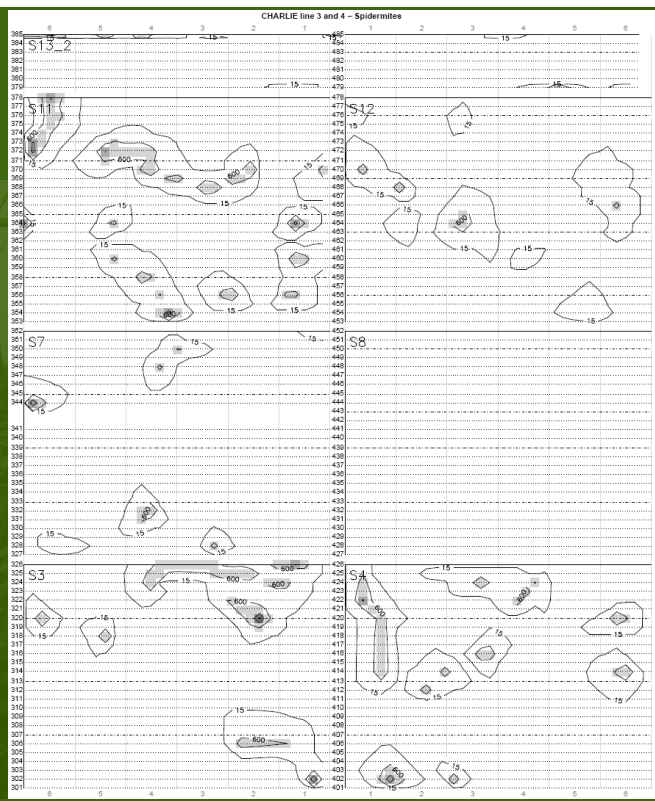
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R   Sybase

LaTeX

Windows Server 2003

Mobilink via GSM

Adaptive Server Anywhere

Daily report to client

Windows Mobile Phone Edition

Three issues:

1. Adjusting geographic coordinates
2. Storing spatial objects in database
3. Interpolation / kriging

Adjusting coordinates in 4 scenarios:

Straight beds:

– Known bed number, unknown bed position

– Known bed number, known bed position

Long winding beds:

– Known bed number, unknown bed position
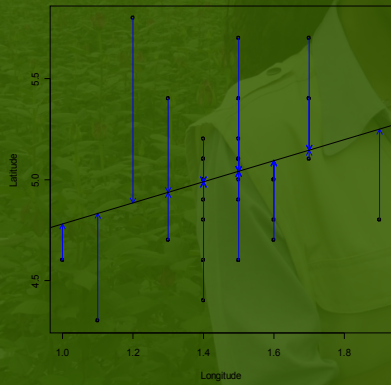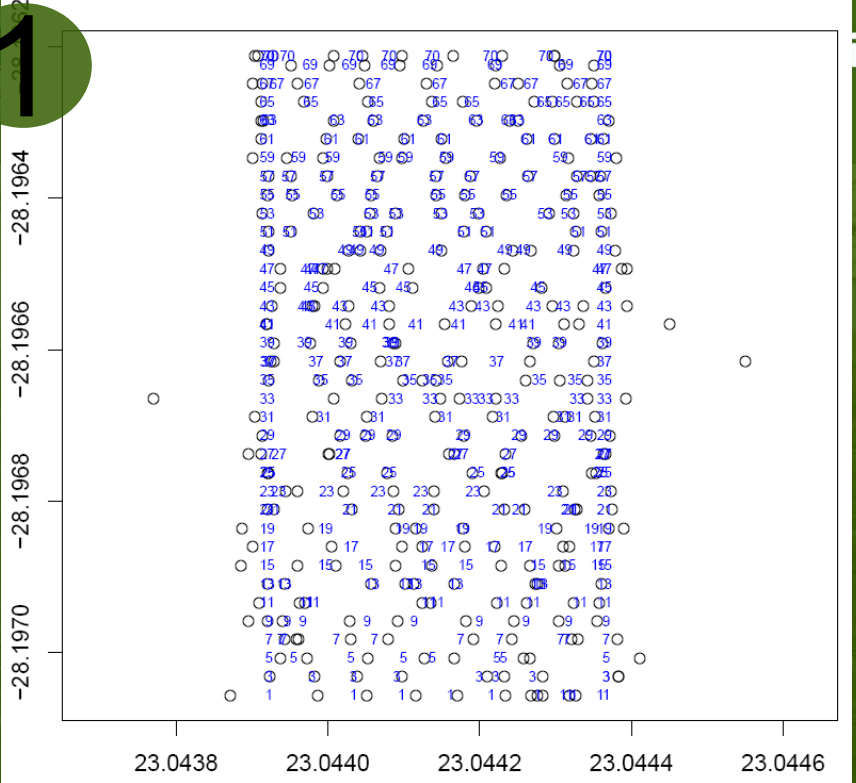
– Known bed number, known bed position

First scenario: Known bed number, unknown bed position
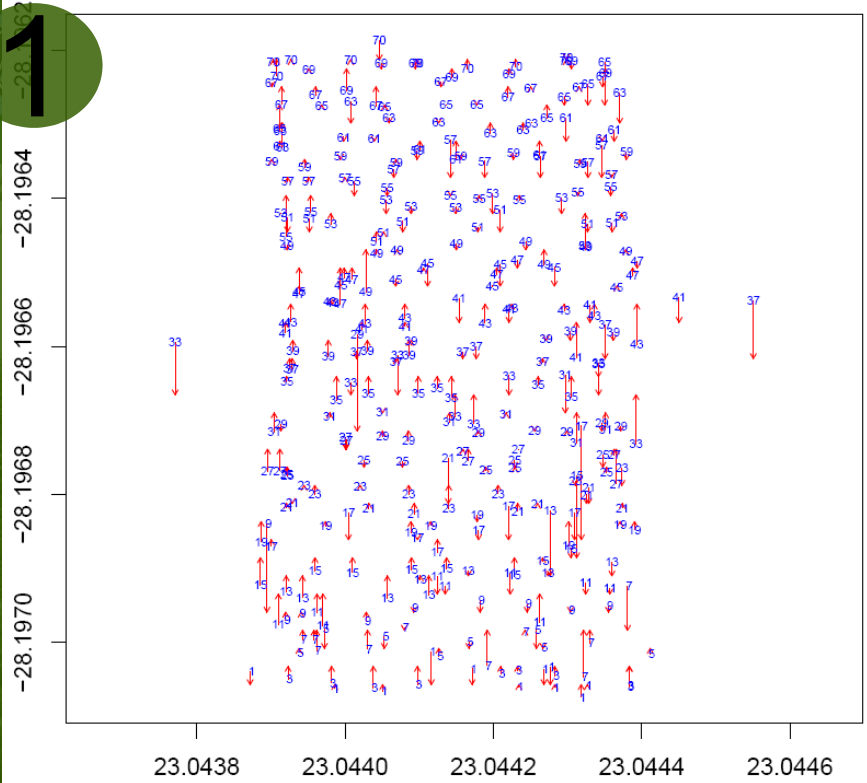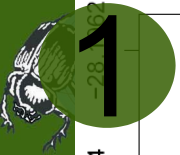
lonlat.lqs <- lqs(lat ~ lon + bed, data = lonlat)

```
lonlat2 <- coords.aniso(lonlat[, 1:2],
    aniso.pars = c(-atan(
        lonlat.lqs$coefficients[[2]])+ns,1))
lonlat2.lm <- lm(lat ~ bed, data = lonlat2)
lonlat2$lat <- predict(lonlat2.lm)
```
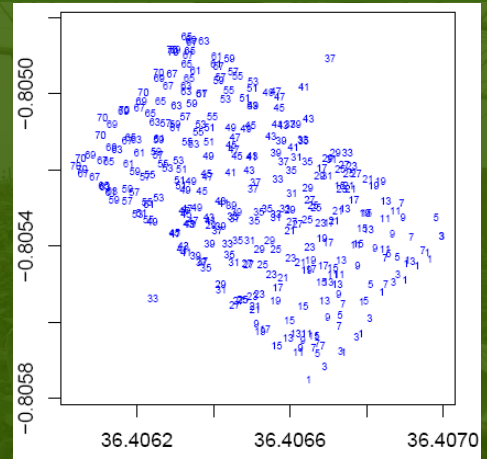
- Second scenario: Known bed number, known bed position
  – Measure layout of beds in greenhouse
  – Measure angle of greenhouse from north
  – Rotate greenhouse so beds parallel to x-axis
  – etc.

What options are there for adjusting the coordinates if the beds aren't straight?

Storing spatial grid in database (coordinates first):

```
GridCoords[, 1] <- Id
GridCoords[, 2] <- paste(xoo, collapse = " ") # xoo is array of longitudes
GridCoords[, 3] <- paste(yoo, collapse = " ") # yoo is array of longitudes
GridCoords[, 4] <- area.sp(AllSPDF)
require(RSQLite)
drv <- dbDriver("SQLite")
conG <- dbConnect(drv, dbname = "ScarabGrid.db")
dbWriteTable(conG, "GridCoords", GridCoords, row.names = FALSE,
    append = TRUE)
dbDisconnect(conG)
```

Storing spatial grid in database (grids):

```
Grids[, 1] <- Id
Grids[, 2] <- c("downy", "ddry")
Grids[1, 3] <- paste(c(downy), collapse = " ") # downy is surface matrices (z)
Grids[2, 3] <- paste(c(ddry), collapse = " ") # ddry is surface matrices (z)
require(RSQLite)
drv <- dbDriver("SQLite")
conG <- dbConnect(drv, dbname = "ScarabGrid.db")
    dbWriteTable(conG, "Grids", Grids, row.names = FALSE, eol = "\r\n",
    append = TRUE)
dbDisconnect(conG)
```

Has anyone else worked with putting R spatial objects in a database?

- Data collected from buds, top, middle and base of the plant for most pests and diseases:

  - Counts
  - Scores (1-5), or
  - Presence / absence

- Currently, all interpolation is with interp() from package akima. Count data transformed logarithmically with log1p().

- Challenges to making full use of R's geospatial capabilities:
  - So many packages to chose from; which one(s) will best address our needs?
  - Automating parameter selection
  - Count data has negative binomial distribution
  - Can we use grid from last scouting as covariable?