Package ‘rivervis’

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Description This R package is a flexible and efficient tool to visualise both quantitative and qualitative data from river surveys. It can be used to produce diagrams with the topological structure of the river network.
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rivervis-package

Description

The *rivervis* package is designed to visualise river ecosystem data.

Details

In general, the *rivervis* package draws two types of diagrams - river charts and river block charts. River charts can present points, lines, bars and blocks in relation to the topological structure of the river network. River block charts show qualitative data without the river network structure. It is recommended to run the examples below and in each function manual. The *rivervis* package contains 15 functions in total.

**RiverLayout** This calculates best fit plotting coordinates for rivers to be shown on river charts. The output is a list, which is used when plotting the river chart and the information on the river chart. It provides an opportunity to change the coordinates and other plotting parameters before actually plotting.

**RiverDraw** This plots the river charts according to the output list of RiverLayout.

**RiverMap** This can be understood as a combination of RiverLayout and RiverDraw. It not only calculates best fit plotting coordinates for rivers to be shown on river charts, but also plots the river charts according to the calculated coordinates. This implies that the coordinates cannot be changed before river chart plotting.

**RiverFrame** This plots river frames, lead lines and anchor points.

**RiverPoint** This plots points or broken lines on the river chart.

**RiverBar** This plots bars for quantitative data on the river chart.

**RiverBlock** This plots blocks for qualitative data on the river chart.

**RiverSite** This plots sites of interest on the river chart.

**RiverLabel** This adds the name labels to the plotted rivers.

**RiverTM** This adds tick marks to the river chart.

**RiverAxisLabel** This adds left or right axis labels to the river chart.

**RiverReach** This highlights river reaches on the river chart.

**RiverDirection** This adds a flow direction arrow on the river chart.

**RiverScale** This adds a plotting scale on the river chart.

**RiverBlockChart** This function plots a river block chart for qualitative data without the topological structure of the river network. The function does not require the output list from RiverLayout or RiverMap.
Author(s)
Feng Mao, Yichuan Shi, and Keith Richards

Examples

data(Ballinderry)

```r
riverlayout <- RiverLayout(B.river$river, B.river$length, B.river$parent,
                           B.river$position, B.river$distance, direction = -1)

# Example Figure 1
RiverDraw(riverlayout)
RiverLabel(riverlayout, offset = -1, corner = "lt", srt = 0, adj = c(0, -0.7))

RiverBar(B.siteaspt$site, B.siteaspt$river, B.siteaspt$distance,
         B.siteaspt[4:5], riverlayout, range = c(0,8),
         bar.col = c("#5381FFFF", "#FF3931FF"), lbl.adj = c(0.5, 1.3))

RiverPoint(B.sitenh4n$site, B.sitenh4n$river, B.sitenh4n$distance,
           B.sitenh4n$NH4N_Spring, riverlayout, type = "o",
           pt.col = "#5381FFFF", pt.pch = 21, pt.bg = "lightblue")

RiverPoint(B.sitenh4n$site, B.sitenh4n$river, B.sitenh4n$distance,
           B.sitenh4n$NH4N_Autumn, riverlayout, type = "o",
           pt.col = "#FF3931FF", pt.pch = 21, pt.bg = "pink")

RiverSite(B.town$town, B.town$river, B.town$distance, B.town$group,
           riverlayout, pt.pch = 22, lbl.shw = FALSE,
           pt.bg = "orange", pt.col = "black")

RiverSite(B.soi$soi, B.soi$river, B.soi$distance, B.soi$group, riverlayout,
           pt.pch = c(25, 24, NA), lbl.shw = FALSE, pt.bg = NA, pt.col = "black")

RiverTM(c(0,2,4,6,8,10), B.siteaspt[4:5], riverlayout, pos=-1, side = "L",
        range = c(0,8), label = c(0,2,4,6,8))

RiverTM(c(0,0.04,0.08,0.12), B.sitenh4n[4:5], riverlayout, pos=-1, side = "R",
        range = c(0,0.15), label = c(0,0.04,0.08,0.12))

RiverAxisLabel("ASPT score", riverlayout, adj = c(0.5, -3))

RiverAxisLabel(expression(paste("N ",H[4],"-N (mg/L)")),
                 riverlayout, side = "R",
                 srt = 270, adj = c(0.5, -3))

legend(0.8, 0.43, inset=0.05, title = "Legend",
       c("ASPT Spring", "ASPT Autumn",
         expression(paste(NH[4],"-N Spring")),
         expression(paste(NH[4],"-N Autumn")),
         "Town", "Unshown left trib",
         "Unshown right trib"),
       lty = c(-1,-1,1,1,-1,-1,-1),
```
pch = c(22,22,21,21,22,25,24),
col = c("black", "black", "#5381FFFF", "#FF3931FF", "black", "black", "black"),
pt.bg = c("#5381FFFF", "#FF3931FF", "lightblue", "pink", "orange", NA, NA),
pt.cex = c(2,2,1,1,1,1),
cex = 0.8)

RiverScale(2, "2 km", riverlayout, loc = c(0.6, 0.1), cex = 0.8)

RiverDirection(riverlayout, arw.length = 0.03,
loc = c(0.6, 0.05), cex = 0.8)

# Example Figure 2

RiverDraw(riverlayout)
RiverLabel(riverlayout, offset = -1, corner = "lt",
srt = 0, adj = c(0, -0.7))

RiverReach(B.reach$Reach, B.reach$River, B.reach$From, B.reach$To,
B.reach$Group, B.reach$Style, riverlayout, rea.lwd = 4,
rea.lty = 3, rea.col = "#51B0A8FF")

RiverPoint(NA, B.elevation$River, B.elevation$Distance,
B.elevation$Elevation, riverlayout)

RiverTM(c(0, 100, 200, 300, 400, 500), B.elevation[3], riverlayout,
pos=-1, side = "R", range = c(0,500),
label = c(0, 100, 200, 300, 400, 500))

RiverAxisLabel("Elevation (m)", riverlayout, side = "R",
srt = 270, adj = c(0.5, -4))

RiverBlock(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
B.sitehm[4:9], riverlayout, c(1,1,2,2),
block.col = fivecolours, lbl.adj = c(0.5,1.3),
par.txt = c("ChanVeg", "ChanFlow", "BankVegLeft", "Right", "RipLULeft", "Right"))

legend(0.8, 0.43, insert=0.05, title = "Legend",
c("High", "Good", "Moderate", "Poor", "Bad",
"Elevation", "Upper Ballinderry SAC"),
pch = c(22,22,22,22,22,NA,22),
pt.bg = c(fivecolours, "black","#51B0A8FF"),
pt.cex = c(2,2,2,2,2,NA,3),
lty = c(NA,NA,NA,NA,NA,1,NA),
cex = 0.8)

RiverScale(2, "2 km", riverlayout, loc = c(0.6, 0.1), cex = 0.8)

RiverDirection(riverlayout, arw.length = 0.03,
loc = c(0.6, 0.05), cex = 0.8)
Ballinderry River Basin Dataset

Description

A ballinderry river basin dataset for demonstrating purposes.

Details

This contains the following 8 datasets and 2 character vectors.

**B.elevation** This dataset can be used to plot elevation profile of Ballinderry Rivers. It is a data frame with 90 observations on the following 3 variables.

- **River** Rivers on which the elevation sites are located
- **Distance** The along-the-river distance between the elevation sites and the mouth of the river.
- **Elevation** A numeric vector of elevation values

**B.reach** Selected Ballinderry River reaches. It is a data frame with 1 observation on the following 6 variables.

- **Reach** Reach names.
- **River** Rivers on which the monitoring sites are located.
- **From** A numeric vector of starting points of reaches.
- **To** A numeric vector of ending points of reaches.
- **Group** A vector of reach group names. This indicates to which group the reaches belong.
- **Style** A vector of reach styles and the location of reach lines.

**B.river** Main rivers and tributaries in Ballinderry Basin for RiverMap and RiverLayout. It is a data frame with 8 observations on the following 5 variables.

- **River** River names.
- **Length** Length of rivers.
- **Position** Relative relations between rivers and their parent rivers.
- **Parent** Parent rivers.
- **Distance** Distance between the mouths of each river and the mouths of each river’s parent.
B.siteaspt  ASPT scores measured in the Ballinderry River Basin in Spring and Autumn, 2009. It is a data frame with 15 observations on the following 5 variables.

<table>
<thead>
<tr>
<th>Site</th>
<th>Site ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Rivers on which the sites are located</td>
</tr>
<tr>
<td>Distance</td>
<td>The along-the-river distance between the sites and the mouth of the river.</td>
</tr>
<tr>
<td>ASPT_Spring</td>
<td>ASPT measure in Spring.</td>
</tr>
<tr>
<td>ASPT_Autumn</td>
<td>ASPT measure in Autumn.</td>
</tr>
</tbody>
</table>

B.sitehm  Selected hydromorphological results from RHAT. The hydromorphological variables are ordinary factors which have five grades: High, Good, Moderate, Poor and Bad. It is a data frame with 17 observations on the following 9 variables.

<table>
<thead>
<tr>
<th>Site</th>
<th>Monitorings sites.</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Rivers on which the monitoring sites are located.</td>
</tr>
<tr>
<td>Distance</td>
<td>The along-the-river distance between the sites and the mouth of the river.</td>
</tr>
<tr>
<td>ChanVeg</td>
<td>Channel vegetation condition.</td>
</tr>
<tr>
<td>ChanFlow</td>
<td>Channel flow condition.</td>
</tr>
<tr>
<td>BankVegLeft</td>
<td>Left bank vegetation condition.</td>
</tr>
<tr>
<td>BankVegRight</td>
<td>Right bank vegetation condition.</td>
</tr>
<tr>
<td>RipLULeft</td>
<td>Left riparian land-use condition.</td>
</tr>
<tr>
<td>RipLURight</td>
<td>Right riparian land-use condition.</td>
</tr>
</tbody>
</table>

B.sitenh4n  NH4-N values measured in the Ballinderry River Basin in Spring and Autumn, 2009. It is a data frame with 17 observations on the following 5 variables.

<table>
<thead>
<tr>
<th>Site</th>
<th>Site ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Rivers on which the sites are located</td>
</tr>
<tr>
<td>Distance</td>
<td>The along-the-river distance between the sites and the mouth of the river.</td>
</tr>
<tr>
<td>NH4N_Spring</td>
<td>NH4-N measure in Spring.</td>
</tr>
<tr>
<td>NH4N_Autumn</td>
<td>NH4-N measure in Autumn.</td>
</tr>
</tbody>
</table>

B.soitown  This dataset provides sites of interest in the Ballinderry River Basin. The sites have three types: towns, conjunctions of left and right tributaries. It is a data frame with 5 observations on the following 4 variables.

<table>
<thead>
<tr>
<th>SOI</th>
<th>Sites of interest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Rivers on which the sites are located.</td>
</tr>
<tr>
<td>Distance</td>
<td>The along-the-river distance between the sites and the mouth of the river.</td>
</tr>
<tr>
<td>Group</td>
<td>Groups of the sites.</td>
</tr>
</tbody>
</table>

B.town  This dataset provides 2 main towns in the Ballinderry River Basin. It has the following 4 variables.

<table>
<thead>
<tr>
<th>Town</th>
<th>Town names.</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Rivers on which the sites are located.</td>
</tr>
<tr>
<td>Distance</td>
<td>The along-the-river distance between the sites and the mouth of the river.</td>
</tr>
<tr>
<td>Group</td>
<td>Groups of the sites.</td>
</tr>
</tbody>
</table>

fivegrades  This vector contains five grades, which are High, Good, Moderate, Poor and Bad.

fivecolours  This vector contains five colours representing the five grades. The five colours are blue(#5381FFFF), green(#7BE859FF), yellow(#FFC944FF), orange(#E87539FF) and red(#FF3931FF).
RiverAxisLabel

Source

North Ireland Environment Agency

Description

This adds left or right axis labels to the river chart.

Usage

RiverAxisLabel(label, riverlayout, cex = 0.7, adj = c(0.5, -2), srt = 90,
               col = "black", pos = NULL, offset = 0.5, side = "L",
               mainonly = TRUE)

Arguments

- label: the axis label to be shown on the river chart.
- riverlayout: the output list of RiverLayout.
- cex: text size.
- adj: text adjustment. One or two values in the range [0,1] for x and y (optional) adjustment.
- srt: text angle.
- col: text colour.
- pos: text position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.
- offset: text position offset.
- side: left ("L") or right ("R") axis.
- mainonly: the axis title is only shown for the main stream only ("TRUE") or not ("FALSE").

Author(s)

Feng Mao

See Also

RiverLayout, RiverDraw, RiverMap, par.
Examples

# see examples below
data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length, B.river$Parent, B.river$Position, B.river$Distance, direction = -1)
RiverDraw(riverlayout)

RiverBar(B.sites$Site, B.sites$River, B.sites$Distance, B.sites$[4:5], riverlayout, range = c(0, 8), bar.col = c("#5381FFFF", "#FF3931FF"), lbl.adj = c(0.5, 1.3))

RiverTM(c(0, 2, 4, 6, 8, 10), B.sites$[4:5], riverlayout, pos=-1, side = "L", range = c(0, 8), label = c(0, 2, 4, 6, 8))

RiverAxisLabel("ASPT score", riverlayout, adj = c(0.5, -3))

RiverBar

River Bar-Chart

Description

This plots bars for quantitative data on the river chart.

Usage

RiverBar(site, river, distance, value, riverlayout, range = NA, bar.w = 1, bar.col = NA, bd.col = "black", lbl.cex = 0.7, lbl.adj = c(0.5, 2), lbl.ofs = 0.5, lbl.col = "black", lbl.srt = 0, lbl.pos = NULL, lbl.shw = TRUE, pt.shw = FALSE)

Arguments

site a character vector of site names.
river a vector of rivers on which the sites are located.
distance a vector. The along-the-river distances between the sites and the mouth of the river.
value a data frame containing the variables to be shown on the bar-chart.
riverlayout the output list of RiverLayout or RiverMap.
range bar-chart value range. A vector of two values indicating lower limit and upper limit.
bar.w relative width of each bar plotted in the diagram. The default value is 1.
bar.col bar colour.
bd.col bar border colour.
RiverBlock

lbl.cex  label size.
lbl.adj  label adjustment. One or two values in [0,1] for x and y (optional) adjustment.
lbl.ofs  label position offset.
lbl.col  label colour.
lbl.srt  label angle.
lbl.pos  label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.
lbl.shw  show labels (TRUE) or not (FALSE).
pt.shw  show location point (TRUE) or not (FALSE).

Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, RiverMap, par.

Examples

data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
  B.river$Parent, B.river$Position,
  B.river$Distance, direction = -1)

RiverDraw(riverlayout)

RiverBar(B.siteaspt$Site, B.siteaspt$River, B.siteaspt$Distance,
  B.siteaspt[4], riverlayout, range = c(0,8),
  bar.col = c("#5381FFFF"), lbl.adj = c(0.5,1.3))

RiverDraw(riverlayout)

RiverBar(B.siteaspt$Site, B.siteaspt$River, B.siteaspt$Distance,
  B.siteaspt[4:5], riverlayout, range = c(0,8),
  bar.col = c("#5381FFFF", "#FF3931FF"), lbl.adj = c(0.5,1.3))

RiverBlock  River Block-Chart

Description
This plots blocks to display qualitative data on the river chart.
Usage

RiverBlock(site, river, distance, value, riverlayout, arrangement,
  pt.shw = FALSE, hw.rat = 1.5, h.gap = 0.05, w.gap = 0.025,
  block.col = NA, block.lwd = 1, bd.col = "grey20", par.shw = TRUE,
  par.pos = 2, par.ofs = 1, par.cex = 0.6, par.adj = c(1, 0.5),
  par.txt = NA, lbl.shw = TRUE, lbl.cex = 0.7, lbl.adj = c(0.5, 2),
  lbl.ofs = 0.5, lbl.col = "black", lbl.srt = 0, lbl.pos = NULL)

Arguments

site                a vector of site names.
river               a vector of rivers on which the sites are located.
distance            a vector. The along-the-river distances between the sites and the mouth of the river.
value               a data frame containing the qualitative variables to be shown on the block-chart.
riverlayout         the output list of RiverLayout or RiverMap.
arrangement         a vector indicating the block number for each line.
pt.shw              show location point (TRUE) or not (FALSE).
hw.rat              the ratio of block height and width in the plotted diagram.
h.gap               vertical gap size between blocks. By default, the vertical gap is river height * 0.05 in each river chart.
w.gap               horizontal gap size between blocks when there is more than one block in each line. By default, the horizontal gap is largest block width * 0.025.
block.col           block colour.
bblock.lwd           block line width.
bd.col               block border col.
par.shw             show parameter names (TRUE) or not (FALSE).
par.pos             parameter label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.
par.ofs             parameter label position offset.
par.cex             parameter label size.
par.adj             parameter label adjustment. One or two values in [0,1] for x and y (optional) adjustment.
par.txt             parameter name.
lbl.shw             show labels (TRUE) or not (FALSE).
lbl.cex             label size.
lbl.adj             label adjustment. One or two values in [0,1] for x and y (optional) adjustment.
lbl.ofs             label position offset.
lbl.col             label colour.
lbl.srt             label angle.
lbl.pos             label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.
Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, RiverMap, par.

Examples

```r
data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
    B.river$Parent, B.river$Position,
    B.river$Distance, direction = -1)

RiverDraw(riverlayout)

RiverBlock(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
    B.sitehm[4:9], riverlayout, c(1,1,2,2),
    block.col = fivecolours, lbl.adj = c(0.5,1.3))

RiverDraw(riverlayout)

RiverBlock(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
    B.sitehm[4:9], riverlayout, c(1,1,2,2),
    block.col = fivecolours, lbl.adj = c(0.5,1.3),
    par.txt = c("ChanVeg", "ChanFlow", "BankVegLeft",
        "Right", "RipLULeft", "Right"))
```

Description

This function plots a river block chart to display qualitative data without the topological structure of the river network. The function does not require the output list from RiverLayout or RiverMap.

Usage

```r
RiverBlockChart(site, river, distance, value, arrangement, h.gap = 0.1,
    w.gap = 0.25, w.gap.s = 0.1, r.gap = 0.25, block.col = NA,
    block.lwd = 1, border.col = "grey20", bg.col = "lightgrey", mar = 0.1,
    hw.rat = 1.5, site.shw = TRUE, site.pos = 1, site.ofs = 1.5,
    site.cex = 0.5, site.col = "black", site.order = "A", site.srt = 0,
    rvr.shw = TRUE, rvr.ofs = 1.5, rvr.cex = 0.7, rvr.col = "black",
    rvr.t.b = "b", rvr.order = NA, rvr.srt = 0, par.shw = TRUE,
    par.pos = 2, par.ofs = 1, par.cex = 0.6, par.adj = c(1, 0.5),
    par.col = "black", par.txt = NA)
```
Arguments

- **site**: a character vector of site names.
- **river**: a vector of rivers to which the sites belong.
- **distance**: a vector. The along-the-river distance between the site and the mouth of the river.
- **value**: a data frame containing the qualitative variables to be shown on the river block-chart.
- **arrangement**: a vector indicating the block number for each line.
- **h.gap**: vertical gap size between blocks in the plot. By default, the vertical gap is block height * 0.1.
- **w.gap**: horizontal gap size between sites. By default, the horizontal gap is largest block width * 0.25.
- **w.gap.s**: horizontal gap size between small blocks when there are more than one block in each line. By default, the horizontal gap is largest block width * 0.1.
- **r.gap**: horizontal gap size between rivers. By default, gap between rivers is block width * 0.25.
- **block.col**: a vector of block colours. The length of vector should be as the same as the the number of levels of `value`.
- **block.lwd**: a value of block line width.
- **border.col**: a value of block border colour.
- **bg.col**: a value of river background colour.
- **mar**: a value of smallest margin size.
- **hw.rat**: the ratio of block height and block width.
- **site.shw**: show site names (TRUE) or not (FALSE).
- **site.pos**: site position. 1 for below, 2 for left, 3 for above, and 4 for right. See `par` for details.
- **site.ofs**: site position offset.
- **site.cex**: site name size.
- **site.col**: site colour.
- **site.order**: order of sites within each river. Alphabetical order ("A"), river flow left ("L"), river flow right ("R").
- **site.srt**: site label rotation in degrees.
- **rvr.shw**: show river labels (TRUE) or not (FALSE).
- **rvr.ofs**: river label position offset.
- **rvr.cex**: river label size.
- **rvr.col**: river label colour.
- **rvr.t.b**: location of river label. "t" for top (above) and "b" for below (bottom).
- **rvr.order**: order of rivers. Alphabetical order (NA) or a vector of custom order.
- **rvr.srt**: river label rotation in degrees.
par.shw  show parameter labels (TRUE) or not (FALSE).
par.pos  parameter label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details. It overrides par.adj if par.pos is not NULL.
par.ofs  parameter label position offset.
par.cex  parameter label size.
par.adj  parameter label adjustment. One or two values in [0,1] for x and y (optional) adjustment.
par.col  parameter label colour.
par.txt  parameter name.

Author(s)
Feng Mao

See Also
par.

Examples

data(Ballinderry)

RiverBlockChart(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
  B.sitehm[4:9], c(1,1,2,2), mar = 0.15, site.ofs = 1,
  site.cex = 0.7, site.order = "R",
  block.col = fivecolours)

RiverBlockChart(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
  B.sitehm[4:9], c(1,1,2,2), mar = 0.15,
  site.ofs = 1, site.cex = 0.7,
  rvr.order = c("Rock", "Killymoon-Claggan", "Ballinderry",
    "Ballymully", "Kildress", "Kingsmill",
    "Lissan", "Tuilacross"),
  block.col = fivecolours)

RiverBlockChart(B.sitehm$Site, B.sitehm$River, B.sitehm$Distance,
  B.sitehm[4:9], c(1,1,2,2), mar = 0.15, site.ofs = 1,
  site.cex = 0.7, site.order = "R",
  par.txt = c("ChanVeg", "ChanFlow", "BankVegLeft",
    "Right", "RipLULeft", "Right"),
  block.col = fivecolours)
RiverDirection

River Direction Arrow

Description

This plots river flow direction arrow on river charts.

Usage

RiverDirection(riverlayout, loc = NA, arw.length = 0.05, arw.lty = 1,
arw.lwd = 1, arw.angle = 30, arw.col = "black",
label = "Flow direction", lbl.cex = 0.5, lbl.pos = 4, lbl.ofs = 0.5)

Arguments

- riverlayout: the output list of RiverLayout or RiverMap.
- loc: location of arrow. One or two values in the range [0, 1] for left and bottom
  margin sizes. If loc = NA, use mouse to locate the arrow. ESC to confirm.
- arw.length: arrow length.
- arw.lty: arrow line style.
- arw.lwd: arrow line width.
- arw.angle: arrow head angle.
- arw.col: arrow colour.
- label: label of the arrow.
- lbl.cex: label size.
- lbl.pos: label position.
- lbl.ofs: label position offset.

Author(s)

Feng Mao

See Also

RiverLayout, RiverDraw, RiverMap, par, locator, arrows.

Examples

data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
B.river$Parent, B.river$Position,
B.river$Distance, direction = -1)

RiverDraw(riverlayout)
RiverDraw

RiverDirection(riverlayout, arw.length = 0.03,
     loc = c(0.8, 0.05), lbl.cex = 0.8)

# Use mouse to allocate the flow direction sign
## RiverDirection(riverlayout, arw.length = 0.03, lbl.cex = 0.8)

---

**Description**

This plots the river chart according to the output list provided by RiverLayout.

**Usage**

RiverDraw(riverlayout, bd.col = "black", ln.col = "grey40", ln.lty = 3,
     ln.lwd = 1, bg.col = "grey80", pt.shw = TRUE, pt.col = "black",
     pt.pch = 20, pt.bg = "black", pt.cex = 1, pt.lwd = 1, mar.t = 0.05,
     mar.b = 0.05, mar.l = 0.2, mar.r = 0.1)

**Arguments**

- **riverlayout** the output list of RiverLayout.
- **bd.col** border colour.
- **ln.col** lead line colour.
- **ln.lty** lead line style.
- **ln.lwd** lead line width.
- **bg.col** background colour.
- **pt.shw** show anchor point (TRUE) or not (FALSE). Anchor points represent the locations of the river mouths.
- **pt.col** anchor point colour.
- **pt.pch** anchor point style.
- **pt.bg** anchor point background(fill) colour when pch=21:25.
- **pt.cex** anchor point size.
- **pt.lwd** anchor point border width.
- **mar.t** top margin size.
- **mar.b** bottom margin size.
- **mar.l** left margin size.
- **mar.r** right margin size.

**Author(s)**

Feng Mao
RiverFrame

Description

This plots river frames, lead lines and anchor points.

Usage

RiverFrame(riverlayout, ln.shw = T, ln.col = "grey40", ln.lty = 3,
ln.lwd = 1, pt.shw = T, pt.col = "black", pt.pch = 20,
pt.bg = "black", pt.cex = 1, pt.lwd = 1, bd.shw = T,
bd.col = "black")

Arguments

riverlayout    the output list of RiverLayout.
ln.shw         show lead lines (TRUE) or not (FALSE).
ln.col         lead line colour.
ln.lty         lead line style.
ln.lwd         lead line width.
pt.shw         show anchor points (TRUE) or not (FALSE). Anchor points represent the locations
                of the river mouths.
pt.col         anchor point colour.
pt.pch         anchor point style.
RiverLabels on River Charts

Description

This adds the name labels to the plotted rivers.

Usage

```r
RiverLabel(riverlayout, cex = 0.7, adj = c(0, -1), srt = 90,
            col = "black", pos = NULL, offset = 0.5, corner = "lb")
```

Arguments

- `riverlayout`: the output list of `RiverLayout` or `RiverMap`.
- `cex`: text size.
- `adj`: text adjustment. One or two values in [0,1] for x and y (optional) adjustment.
- `srt`: text angle.
- `col`: text colour.
pos text position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details. It overrides adj if it is not NULL.

offset text position offset.

corner river label position, which can be at any of the four river chart corners. "lt" for left-top, "lb" for left-bottom, "rt" for right-top, "rb" for right-bottom.

Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, RiverMap, par.

Examples

data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
B.river$Parent, B.river$Position,
B.river$Distance, direction = -1)

RiverDraw(riverlayout)

RiverLabel(riverlayout, corner = "lt", srt = 0, adj = c(0, -0.7))

RiverLabel(riverlayout, corner = "lb")

RiverLabel(riverlayout, corner = "rt", srt = -90)

RiverLayout River Layout Coordinates Calculation

Description
This function calculates best fit plotting coordinates to enable rivers to be shown on river charts. The output is a list, which can be used when plotting the river chart and the information on the river chart. It provides an opportunity to change the coordinates and other plotting parameters before actually plotting.

Usage

RiverLayout(river, length, parent, position, distance, row = NA,
direction = 1, margin = 0.5)
RiverLayout

Arguments

- **river**: a vector of river names.
- **length**: a vector of river lengths.
- **parent**: a vector of river parents. The parent of a river is the river into which it flows. The parent of the main stream is "NA".
- **position**: a vector of river positions. The river position indicates its position relative to its parent - whether it is a left bank river, right bank river or main stream. The left bank river is on the left when looking downstream of its parent. The right bank river is on the right when looking downstream of its parent. The value of position can be "R", "L" or "M". For the main stream, the value is "M".
- **distance**: a vector of distances denotes the distance between the mouths of each river and the mouths of each river's parent.
- **row**: a vector of row numbers. The main stream is on row 0. In the river chart, rivers with negative row numbers are plotted below the main stream while rivers with positive row numbers are plotted above the main stream. If a value for row is provided, the rivers will be plotted according to the provided row numbers. If a value for row is not provided, a vector of best fit row numbers will be calculated before plotting.
- **direction**: a value. In the river chart, rivers flow from right to left (direction = 1), or from left to right (direction = -1). By default, direction = 1.
- **margin**: a value. The margin height between rivers in the topological plot. By default, margin = 0.5 and margin height is 0.5 times the river height in the river chart.

Value

The RiverLayout returns a list containing the data for river chart plotting. The list includes,

- **riverdata**: a data frame. This contains input vectors river, length, parent, position and distance. It also includes calculated x-coordinates of river mouths (rmouth) and sources (rsource), defined in the same units as the inputs length and distance. The last vector included is the row number for each river (row), in which the main stream has a fixed row number of 0.

- **H.MAX**: the number of river rows.
- **H.SIZE**: the height of each river row in the topological plot.
- **W.MAX**: the width of river layout, in the same units as length and distance.
- **W.SIZE**: the reciprocal of W.MAX.
- **X1**: normalised x-coordinate of river mouths.
- **X2**: normalised x-coordinate of river sources.
- **Y**: normalised y-coordinate of rivers.
- **direction**: flow direction. Rivers flow from right to left (direction = 1), or from left to right (direction = -1).

Note

There is one and only one mainstream input for each function call.
**Author(s)**
Feng Mao

**See Also**
RiverDraw, RiverMap.

**Examples**
data(Ballinderry)

# River flows right
riverlayout <- RiverLayout(B.river$river, B.river$length, 
B.river$parent, B.river$position, 
B.river$distance, direction = 1)

# River flows left
riverlayout.left <- RiverLayout(B.river$river, B.river$length, 
B.river$parent, B.river$position, 
B.river$distance)

str(riverlayout)

---

**Description**
This function calculates plotting coordinates for rivers and draws the river chart accordingly.

**Usage**

RiverMap(river, length, parent, position, distance, row = NA, direction = 1, 
margin = 0.5, bd.col = "black", ln.col = "grey40", ln.lty = 3, 
ln.lwd = 1, bg.col = "grey80", pt.shw = TRUE, pt.col = "black", 
pt.pch = 20, pt.bg = "black", pt.cex = 1, pt.lwd = 1, mar.t = 0.05, 
mar.b = 0.05, mar.l = 0.2, mar.r = 0.1)

**Arguments**

- **river** a vector of river names.
- **length** a vector of river lengths.
- **parent** a vector of river parents. The parent of a river is the river into which it flows. The parent of the main stream is NA.
position

a vector of river positions. The river position indicates its position relative to its parent - whether it is a left bank river, right bank river or main stream. The left bank river is on the left when looking downstream of its parent. The right bank river is on the right when looking downstream of its parent. The value of position can be "R", "L" or "M". For the main stream, the value is "M".

distance

a vector of distances denotes the distance between the mouths of each river and the mouths of each river’s parent.

row

a vector of row numbers. The main stream is on row 0. In the river chart, rivers with negative row numbers are plotted below the main stream while rivers with positive row numbers are plotted above the main stream. If a value for row is provided, the rivers will be plotted according to the provided row numbers. If a value for row is not provided, a vector of best fit row numbers will be calculated before plotting.

direction

a value. In the river chart, rivers flow from right to left (direction = 1), or from left to right (direction = -1). By default, direction = 1.

margin

a value. The margin height between rivers in the topological plot. By default, margin = 0.5 and margin height is 0.5 times the river height in the river chart.

bd.col

eriver border colour.

ln.col

lead line colour.

ln.lty

lead line style.

ln.lwd

lead line width.

bg.col

background colour.

pt.shw

show anchor point (TRUE) or not (FALSE). Anchor points represent the locations of the river mouths.

pt.col

anchor point colour.

pt.pch

anchor point character.

pt.bg

anchor point background(fill) colour when pch=21:25.

pt.cex

anchor point size.

pt.lwd

anchor point border width.

mar.t

top margin size. This ranges in [0, 1] where 1 is the total height of the diagram region.

mar.b

bottom margin size. This ranges in [0, 1] where 1 is the total height of the diagram region.

mar.l

left margin size. This ranges in [0, 1] where 1 is the total width of the diagram region.

mar.r

right margin size. This ranges in [0, 1] where 1 is the total width of the diagram region.

Value

The RiverMap returns a list containing data for river map drawing, and plots the river map accordingly. The output list can be used for further plotting. The output list includes,
riverdata a data frame. This contains input vectors river, length, parent, position and distance. It also includes calculated x-coordinates of river mouths (rmouth) and sources (rsource), defined in the same units as the inputs length and distance. The last included vector is the row number for each river (row), in which the main stream has a fixed row number of 0.

H.MAX the number of rows.
H.SIZE the height of each row in the topological plot.
W.MAX the width of river layout, in the same units as length and distance.
W.SIZE the reciprocal of W.MAX.
X1 normalised x-coordinate of river mouths.
X2 normalised x-coordinate of river sources.
Y normalised y-coordinate of rivers.
direction flow direction. Flow from right to left (direction = 1), or from left to right (direction = -1).

Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, par.

Examples

data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
                            B.river$Parent, B.river$Position,
                            B.river$Distance, direction = -1)

str(riverlayout)

RiverMap(B.river$River, B.river$Length, B.river$Parent,
         B.river$Position, B.river$Distance)[[1]]

RiverMap(B.river$River, B.river$Length, B.river$Parent,
         B.river$Position, B.river$Distance,
         row = c(5,-1,6,3,-4,2,-6,7), direction = -1)

RiverPoint Points on River Charts

Description
This function plots scatter points or broken lines on the river chart.
Usage

RiverPoint(site, river, distance, value, riverlayout, range = NA, type = "l", pt.col = "grey40", pt.bg = "black", pt.pch = 20, pt.cex = 1, lbl.cex = 0.7, lbl.adj = c(0.5, 2), lbl.ofs = 0.5, lbl.col = "black", lbl.srt = 0, lbl.pos = NULL, lbl.shw = FALSE, ln.lwd = 1)

Arguments

site a vector of site IDs.
river a vector of river names.
distance a vector of distances from sites to the river mouth.
value a vector of values.
riverrlayout the output list of RiverLayout or RiverMap.
range point value range. A vector of two values indicating lower limit and upper limit.
type type of plot. See plot for details. The default value is "l", which means "lines".
pt.col point or point border colour.
pt.bg point point background(fill) colour when pt.pch=21:25.
pt.pch point style.
pt.cex point size.
lbl.cex label size.
lbl.adj label adjustment. One or two values in [0,1] for x and y (optional) adjustment.
lbl.ofs label position offset.
lbl.col label colour.
lbl.srt label angle.
lbl.pos label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.
lbl.shw show labels (TRUE) or not (FALSE).
ln.lwd line width.

Author(s)

Feng Mao

See Also

RiverLayout, RiverDraw, RiverMap, par.
Examples

data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length, B.river$Parent, B.river$Position, B.river$Distance, direction = -1)

RiverDraw(riverlayout)

RiverPoint(B.elevation$Site, B.elevation$River, B.elevation$Distance, B.elevation$Elevation, riverlayout)

RiverPoint(B.sitenh4n$Site, B.sitenh4n$River, B.sitenh4n$Distance, B.sitenh4n$NH4N_Spring, riverlayout, type = "o", pt.col = "#5381FFFF", pt.pch = 21, pt.bg = "lightblue")

RiverPoint(B.sitenh4n$Site, B.sitenh4n$River, B.sitenh4n$Distance, B.sitenh4n$NH4N_Autumn, riverlayout, type = "o", pt.col = "#FF3333FF", pt.pch = 21, pt.bg = "pink", lbl.shw = TRUE)

---

RiverReach

River Reach Plotting

Description

This highlights river reaches on the river chart.

Usage


Arguments

reach a vector of reach names.
river a vector of rivers to which the reaches belong.
from a numeric vector of starting points.
to a numeric vector of ending points.
group a vector of reach group names. This indicates to which group the reaches belong.
style a vector of reach styles. The value of "style" denotes the location of reach lines. Especially, 0 denotes "on axis" and 99 means "the reach is presented as a band rather than a line".
riverlayout the output list of RiverLayout or RiverMap.
rea.pos a vector of absolute positions of lines. The values range in [0,1].
rea.col line colour.
rea.lty line style.
rea.lwd line width.
rea.den the density of shading lines, in lines per inch. See rect.
bd.col colour of river chart frames.
ln.shw show lead lines (TRUE) or not (FALSE).
ln.col lead line colour.
ln.lty lead line style.
ln.lwd lead line width.
pt.shw show anchor point (TRUE) or not (FALSE). Anchor points represent the locations of the river mouths.
pt.col anchor point colour.
pt.pch anchor point style.
pt.bg anchor point background(fill) colour when pch=21:25.
pt.cex anchor point size.
pt.lwd anchor point border width.

Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, RiverMap, par.

Examples

```r
data(Ballinderry)

riverlayout <- RiverLayout(B$river$River, B$river$Length,
                          B$river$Parent, B$river$Position,
                          B$river$Distance, direction = -1)

RiverDraw(riverlayout)

RiverReach(B$reach$Reach, B$reach$River, B$reach$From,
           B$reach$To, B$reach$Group, B$reach$Style, riverlayout,
           rea.lwd = 5)

RiverReach(B$reach$Reach, B$reach$River, B$reach$From,
           B$reach$To, B$reach$Group, 2, riverlayout,
           rea.col = "darkred", rea.lwd = 5)
```
**RiverScale**  

**River Chart Scale**

**Description**

This plots the scale of river charts.

**Usage**

```r
RiverScale(length, label, riverlayout, loc = NA, scl.col = "black",
            scl.lwd = 1, lbl.cex = 0.5, lbl.pos = 4, lbl.ofs = 0.5)
```

**Arguments**

- `length`: the length of the scale. The length is defined in the same units as the river length. The function will convert this real length into a segment with the same scale as the rivers, and plot it on the river chart.
- `label`: a string defining a scale label indicating the real length the scale segment represents.
- `riverlayout`: the output list of `RiverLayout` or `RiverMap`.
- `loc`: location of scale. One or two values in the range [0, 1] to define left and bottom margin sizes. If `loc = NA`, use mouse to locate the arrow. ESC to confirm.
- `scl.col`: scale colour.
- `scl.lwd`: scale line width.
- `lbl.cex`: scale label size.
- `lbl.pos`: scale label position. 1 for below, 2 for left, 3 for above, and 4 for right. See `par` for details.
- `lbl.ofs`: scale label position offset.

**Author(s)**

Feng Mao

**See Also**

`RiverLayout`, `RiverDraw`, `RiverMap`, `par`, `locator`.

**Examples**

```r
data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
                            B.river$Parent, B.river$Position,
                            B.river$Distance, direction = -1)

RiverDraw(riverlayout)
```
Description

This plots sites of interest on the river chart.

Usage

\[
\text{RiverSite}(\text{site}, \text{river}, \text{distance}, \text{group}, \text{riverlayout}, \text{pt.pch} = 21, \\
\text{pt.col} = \text{NA}, \text{pt.bg} = \text{"red"}, \text{pt.cex} = 1, \text{lbl.cex} = 0.5, \text{lbl.srt} = 0, \\
\text{lbl.adj} = \text{c}(0.5, 2), \text{lbl.col} = \text{"black"}, \text{lbl.pos} = 1, \text{lbl.ofs} = 0.5, \\
\text{lbl.shw} = \text{TRUE})
\]

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>site</td>
<td>a character vector of site names.</td>
</tr>
<tr>
<td>river</td>
<td>a vector of rivers on which the sites are located.</td>
</tr>
<tr>
<td>distance</td>
<td>a vector. The along-the-river distance between the site and the mouth of the river.</td>
</tr>
<tr>
<td>group</td>
<td>a vector. Group names of river locations.</td>
</tr>
<tr>
<td>riverlayout</td>
<td>the output list of RiverLayout or RiverMap.</td>
</tr>
<tr>
<td>pt.pch</td>
<td>point style.</td>
</tr>
<tr>
<td>pt.col</td>
<td>point border colour.</td>
</tr>
<tr>
<td>pt.bg</td>
<td>point background(fill) colour when pt.pch=21:25.</td>
</tr>
<tr>
<td>pt.cex</td>
<td>point size.</td>
</tr>
<tr>
<td>lbl.cex</td>
<td>label size.</td>
</tr>
<tr>
<td>lbl.srt</td>
<td>label angle.</td>
</tr>
<tr>
<td>lbl.adj</td>
<td>label adjustment. One or two values in [0,1] for x and y (optional) adjustment.</td>
</tr>
<tr>
<td>lbl.col</td>
<td>label colour.</td>
</tr>
<tr>
<td>lbl.pos</td>
<td>label position. 1 for below, 2 for left, 3 for above, and 4 for right. See par for details.</td>
</tr>
<tr>
<td>lbl.ofs</td>
<td>label position offset.</td>
</tr>
<tr>
<td>lbl.shw</td>
<td>show labels (TRUE) or not (FALSE).</td>
</tr>
</tbody>
</table>

Author(s)

Feng Mao
See Also

RiverLayout, RiverDraw, RiverMap, par.

Examples

```r
data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
B.river$Parent, B.river$Position,
B.river$Distance, direction = -1)
RiverDraw(riverlayout)

RiverSite(B.soi$SOI, B.soi$River, B.soi$Distance, B.soi$Group, riverlayout,
pt.bg = c("red","green","yellow"), lbl.shw = FALSE)
RiverDraw(riverlayout)

RiverSite(B.town$Town, B.town$River, B.town$Distance, B.town$Group,
riverlayout, pt.pch = 22, lbl.shw = FALSE,
pt.bg = "orange", pt.col = "black")

RiverSite(B.soi$SOI, B.soi$River, B.soi$Distance, B.soi$Group,
rivertm

rivertm

Tick Marks on River Charts

Description

This adds tick marks to the river chart.

Usage

rivertm(tickmark, value, riverlayout, range = NA, side = "L", pos = 1,
  tm.l = 1, tm.col = "black", lbl.shw = TRUE, lbl.col = "black",
  lbl.cex = 0.7, lbl.row = TRUE, label = NA)

Arguments

tickmark     a vector of tick mark values.
value        the variables which the tick marks are for.
riverlayout  the output list of RiverLayout or RiverMap.
range        bar-chart value range. A vector of two values indicating lower limit and upper limit.
side         position of tick marks. "1" for left and "r" for right.
pos          position of tick marks. -1 for in and 1 for out.
tm.l  tick mark length.
tm.col tick mark colour.
llbl.shw show labels of tick marks (TRUE) or not (FALSE).
llbl.col label colour.
llbl.cex label size.
llbl.row show one label per row (TRUE) or not (FALSE).
llabel a vector of tick mark labels.

Author(s)
Feng Mao

See Also
RiverLayout, RiverDraw, RiverMap, par.

Examples
data(Ballinderry)

riverlayout <- RiverLayout(B.river$River, B.river$Length,
B.river$Parent, B.river$Position,
B.river$Distance, direction = -1)
RiverDraw(riverlayout)
RiverPoint(NA, B.elevation$River, B.elevation$Distance,
B.elevation$Elevation, riverlayout)
RiverTM(c(0, 100, 200, 300, 400, 500), B.elevation[3], riverlayout,
pos=-1, side = "R", range = c(0,500),
label = c(0, 100, 200, 300, 400, 500))
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