

Package: Roryza (via r-universe)

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Description An R/C++ implementation of the ORYZA rice crop growth model. ORYZA is a dynamic simulation model that uses daily weather data and crop, soil and management parameters to simulate rice growth and development. See Bouman et al. (2001) ORYZA2000: modeling lowland rice. IRRI / Wageningen University.

Type Package

Title ORYZA Rice Crop Growth Simulation Model

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LinkingTo Rcpp

Imports meteor, methods (>= 0.2-2), Rcpp (>= 0.12.4)

Suggests tinytest, terra, raster

URL <https://github.com/cropmodels/Roryza>

BugReports <https://github.com/cropmodels/Roryza/issues>

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Roryza-package	<i>ORYZA Rice Crop Growth Simulation Model</i>
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Description

This package provides an R interface to a C++ implementation of the ORYZA simulation model of rice growth and development.

References

Bouman, B.A.M., Kropff, M.J., Tuong, T.P., Wopereis, M.C.S., ten Berge, H.F.M., & van Laar, H.H. (2001). ORYZA2000 : modeling lowland rice. International Rice Research Institute / Wageningen University. https://books.irri.org/9712201716_content.pdf

oryza	<i>ORYZA rice crop growth model</i>
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Description

Run the ORYZA rice crop growth model (potential or water-limited).

Usage

oryza(crop, weather, soil, control)

Arguments

- | | |
|---------|---|
| crop | list. Crop parameters (see oryza_crop) |
| weather | data.frame with weather data |
| soil | list. Soil parameters (see oryza_soil); used when water_limited=TRUE |
| control | list. Model control options (see oryza_control) |

Details

Weather variables

date	Date	-
srad	Solar radiation	kJ m ⁻² day ⁻¹
tmin, tmax	Temperature	degrees C
vapr	Vapor pressure	kPa
wind	Wind speed	m s ⁻¹
prec	Precipitation	mm day ⁻¹

Set `control$water_limited <- TRUE` and supply a PADDY soil for water-limited production.

Irrigation is controlled by `control$SWITIR` (0=rainfed, 2=pond depth, 3=soil KPa, 6=stage thresholds).

Value

data.frame with daily simulation results.

See Also

[oryza_model](#), [oryza_crop](#), [oryza_soil](#), [oryza_control](#)

Examples

```
# weather data (IRRI, Los Banos)
f <- system.file("extdata/Philippines_IRRI.csv", package="meteor")
wth <- read.csv(f)
wth$date <- as.Date(wth$date)
head(wth)

crop <- oryza_crop("IR72")
soil <- oryza_soil("potential")
control <- oryza_control()
control$modelstart <- as.Date("1991-01-15")
control$latitude <- 14.18
control$elevation <- 21

# potential production
out <- oryza(crop, wth, soil, control)
tail(out)
plot(out$date, out$LAI, type="l", xlab="Date", ylab="LAI")

# water-limited (rainfed PADDY)
soil <- oryza_soil("paddy")
control$water_limited <- TRUE
control$SWITIR <- 0L
outw <- oryza(crop, wth, soil, control)
plot(outw$date, outw$WSO, type="l", xlab="Date", ylab="Storage organs (kg/ha)")
```

oryza_control	<i>ORYZA control parameters</i>
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Description

Returns a list of control and experiment parameters to run the ORYZA model. Important fields include modelstart, cropstart, max_duration, latitude, CO2, water_limited, and WATBAL. See Bouman et al. (2001) .

Usage

```
oryza_control(filename = "")
```

Arguments

filename	character. Path to a control INI file. If empty, default values are returned
----------	--

Value

list

Note

In the FORTRAN versions of ORYZA these parameters in the "experiment" file, not in the "control" file.

See Also

[oryza](#), [oryza_model](#)

Examples

```
contr <- oryza_control()
str(contr)
```

oryza_crop	<i>ORYZA crop parameters</i>
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Description

Returns a list of crop parameters for the ORYZA model. Built-in varieties are provided as INI files under inst/oryza/crop. See Bouman et al. (2001) for parameter interpretation.

Usage

```
oryza_crop(name = "")
```

Arguments

name character. Either the name of a crop that comes with the package (see examples) or a path to a similarly formatted INI file. If empty, the available crop names are returned

Value

list

See Also

[oryza](#), [oryza_model](#)

Examples

```
oryza_crop("")
crop <- oryza_crop("IR72")
str(crop)
```

oryza_model

ORYZA model object interface

Description

Create an ORYZA model object and run it. Through this interface you first create a model object and then you run it. You can change single parameters and run the model again.

Usage

```
oryza_model(crop, weather, soil, control)
run(x, ...)
crop(x) <- value
soil(x) <- value
control(x) <- value
weather(x) <- value
```

Arguments

crop	list. Crop parameters (see oryza_crop)
weather	data.frame with weather data. See Details
soil	list. Soil parameters (see oryza_soil)
control	list. Model control options (see oryza_control)
x	ORYZA model object (Rcpp_OryzaModel)
value	crop, weather, soil, or control data, as above
...	additional arguments. stopError (logical): if an error occurs and stopError is TRUE, an error is thrown; otherwise a warning is given and partial simulation data may be returned

Details

The weather data must be passed as a data.frame with the following variables and units.

variable	description	class / unit
date	"Date" class variable	-
srad	Solar radiation	kJ m ⁻² day ⁻¹
tmin	Minimum temperature	degrees C
tmax	Maximum temperature	degrees C
vapr	Vapor pressure	kPa
wind	Wind speed	m s ⁻¹
prec	Precipitation	mm day ⁻¹

There should be no time gaps between the days in the data.frame.

Value

oryza_model returns an OryzaModel object. run returns a data.frame of daily simulation results.

References

Bouman, B.A.M., Kropff, M.J., Tuong, T.P., Wopereis, M.C.S., ten Berge, H.F.M., & van Laar, H.H. (2001). ORYZA2000 : modeling lowland rice. International Rice Research Institute / Wageningen University. https://books.irri.org/9712201716_content.pdf

See Also

[oryza](#), [oryza_crop](#), [oryza_soil](#), [oryza_control](#), [predict](#)

Examples

```
# weather data (IRRI, Los Banos)
f <- system.file("extdata/Philippines_IRRI.csv", package="meteor")
wth <- read.csv(f)
wth$date <- as.Date(wth$date)

crop <- oryza_crop("IR72")
soil <- oryza_soil("paddy")
control <- oryza_control()
control$modelstart <- as.Date("1991-01-15")
control$latitude <- 14.18
control$elevation <- 21
control$water_limited <- TRUE
control$SWITIR <- 0L

m <- oryza_model(crop, wth, soil, control)
out <- run(m)
plot(out$date, out$LAI, type="l", xlab="Date", ylab="LAI")

# change soil / control and re-run
```

```
soil(m) <- oryza_soil("potential")
control$water_limited <- FALSE
control(m) <- control
out2 <- run(m)
plot(out2$date, out2$WSO, type="l", xlab="Date", ylab="Storage organs (kg/ha)")
```

oryza_soil

ORYZA soil parameters

Description

Returns a list of soil parameters for the ORYZA model. Built-in soils are provided as INI files under `inst/oryza/soil`. Use "potential" when running potential production (water balance not used). See Bouman et al. (2001) for parameter interpretation.

Usage

```
oryza_soil(name = "")
```

Arguments

name	character. Either the name of a soil that comes with the package (see examples) or a path to a similarly formatted INI file. If empty, the available soil names are returned
------	--

Value

list

See Also

[oryza](#), [oryza_model](#)

Examples

```
oryza_soil("")
soil <- oryza_soil("paddy")
str(soil)
```

predict	<i>Spatial ORYZA model predictions</i>
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Description

Make spatial predictions with an ORYZA model. First create a model object with crop and control settings, then call `predict` with a weather `SpatRasterDataset` and a soils `SpatRaster`.

Usage

```
## S4 method for signature 'Rcpp_OryzaModel'
predict(object, weather, mstart, soils = NULL,
        soiltypes = NULL, filename = "", overwrite = FALSE, ...)
```

Arguments

<code>object</code>	ORYZA model (<code>Rcpp_OryzaModel</code>)
<code>weather</code>	<code>SpatRasterDataset</code> with daily weather. Required sub-datasets: <code>tmin</code> , <code>tmax</code> , <code>srad</code> . For water-limited runs also <code>prec</code> , <code>vapr</code> , and <code>wind</code> . All must share the same number of layers; <code>tmin</code> must have Date time stamps
<code>mstart</code>	Date. Simulation start dates (one output layer per date)
<code>soils</code>	<code>SpatRaster</code> . Must include layers <code>latitude</code> and <code>elevation</code> . For water-limited runs also <code>soil</code> (1-based index into <code>soiltypes</code>) and <code>soildepth</code> (maximum rootable depth in m; used as ZRTMS)
<code>soiltypes</code>	list of soil parameter lists (see oryza_soil). Required for water-limited runs; optional for potential (defaults to <code>oryza_soil("potential")</code>)
<code>filename</code>	character. Optional output filename
<code>overwrite</code>	logical. If TRUE, overwrite filename
<code>...</code>	additional arguments passed to writeRaster

Value

`SpatRaster` with one layer per element of `mstart`. Cell values are final grain biomass at 14% humidity (WRR14, kg ha^{-1} , rounded).

Note

Weather variables and units are the same as for the point simulation: `srad` in $\text{kJ m}^{-2} \text{d}^{-1}$, `vapr` in kPa, `prec` in mm d^{-1} , temperatures in $^{\circ}\text{C}$, `wind` in m s^{-1} .

See Also

[oryza_model](#), [oryza](#)

Examples

```

f <- system.file("extdata/Philippines_IRRI.csv", package="meteor")
w <- read.csv(f)[1:600, ]
w$date <- as.Date(w$date)

r <- terra::rast(nrow=2, ncol=2, nlyr=nrow(w))
v <- c("srad", "tmin", "tmax", "vapr", "wind", "prec")
wthfun <- function(i) {
  a <- rep(0, 4)
  if ((i == "tmin") || (i == "tmax")) {
    a <- c(-2, 0, 2, 4)
  }
  out <- terra::setValues(r, rbind(w[,i]+a[1], w[,i]+a[2], w[,i]+a[3], w[,i]+a[4]))
  terra::time(out) <- as.Date(w$date)
  out
}

wth <- terra::sds(lapply(v, wthfun))
names(wth) <- v

crop <- oryza_crop("IR72")
soil <- oryza_soil("paddy")
control <- oryza_control()
control$water_limited <- FALSE
control$SWITIR <- 0L
mod <- oryza_model(crop, w, soil, control)

soils <- terra::rast(nrow=2, ncol=2, nlyr=3, names=c("latitude", "elevation", "soils"))
terra::values(soils) <- cbind(0, 100, 1:4)

p <- predict(mod, wth, mstart=as.Date(c("1979-01-05", "1979-05-05")), soils=soils)

```

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