

Package ‘Wisclakebathy’

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Type Package

Title Wisconsin Lake Bathymetry Calculations

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Author Carolyn Voter <cvoter@wisc.edu>

Maintainer Carolyn Voter <cvoter@wisc.edu>

Description Calculations related to lake depth, area, and volume and changes in these values.

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R topics documented:

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area_loss_given_depth_change

Calculate percent loss of lake area with Xft change in lake depth

Description

Given a data frame with information about "WBIC", "depth_feet", and "area_acres" and what reduction in max depth (ft) to assume, calculates the estimated change in lake area (Assumes a linear change in depth and area between specified contour intervals in order to approximate lower lake area

Usage

```
area_loss_given_depth_change(df, depth_change_ft = 1)
```

Arguments

df data frame with information about "WBIC", "lake", "depth_feet", and "area_acres". Input data frame may have other columns, but must have these.

depth_change_ft Specify what reduction in lake depth from maximum lake depth to evaluate. Defaults to 1 (ft).

Value

data frame with the following columns:

| | |
|----------------|---|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in the input data frame. Typically something like "easthorsehead", just to help with quick identification) |
| max_depth | maximum lake depth (ft) |
| max_area | lake area corresponding to maximum lake depth (acres) |
| lower_depth | lake depth assuming Xft reduction (as input, default is 1ft reduction) (ft) |
| lower_area | volume corresponding to lowered depth (acres) |
| area_pcnt_loss | percentage change in lake area relative to maximum lake area given a Xft reduction in lake depth (as input, default is 1ft reduction) |

| | |
|-------------------|--|
| calculate_volumes | <i>Calculate lake volumes (acre-ft) from lake areas (acres) and lake depths (ft)</i> |
|-------------------|--|

Description

Given a data frame with information about "WBIC", "depth_feet", and "area_acres" and which type of volume estimate to use ("trapezoidal" or "conical"), calculates the lake volume in acre-ft associated with each lake depth. Note that this approach assumes that information about "depth_feet" is arranged such that the maximum depth value corresponds with the lake surface and the maximum lake volume value, while a depth value of 0 corresponds with the lake bottom and a lake volume of 0.

Usage

```
calculate_volumes(df, method = "trapezoidal")
```

Arguments

| | |
|--------|---|
| df | data frame with information about "WBIC", "depth_feet", and "area_acres". Input data frame may have other columns, but must have these. |
| method | Specify which volume estimation approach to use. Options include "trapezoidal" or "conical". Defaults to "trapezoidal". |

Value

the input data frame with an additional column for "volume_acre_ft" appended, which represents the lake volume at the given lake depth (acre-ft).

```
convert_data_thief_volumes
```

Convert depth vs. volume information obtained via DataThief into standard format

Description

Given the path of a directory where txt files from DataThief output live, reads in information about depth (ft) vs. volume (acre-ft) relationship and converts to standard format for other analyses.

Usage

```
convert_data_thief_volumes(path, max_file, flip = TRUE, depth_interval = 3)
```

Arguments

| | |
|----------------|---|
| path | Path of directory containing all txt files with depth and volume info (extracted from bathymetry maps using DataThief), e.g. "data-raw/CS_DataThief". See details in description about expected format of these txt files. |
| max_file | Name of csv file with information about maximum areas of each lake, e.g. "WI_maxes.csv". See details in description about expected format of this csv file. |
| flip | Indicates whether should flip depths so that the maximum depth/volume corresponds to the lake surface and a depth/volume of zero corresponds to the lake bottom (TRUE) or keep as-is, with a depth of zero corresponding to the lake surface (FALSE). Defaults to TRUE to flip. |
| depth_interval | optional parameter specifies what depth contour interval to extrapolate volume information at. Defaults to 3ft. |

Details

Expects txt files with depth vs. volume information to adhere to the following conventions: *

- All txt files are stored in the same directory (specified by "path")
- * Filenames are "singlelake-name_WBIC.csv", e.g. "easthorsehead_1523000.txt"
- * Each file starts with a header from DataThief that should be deleted
- * Columns are unnamed but represent (in order): "volume_acre_ft", "depth_feet"
- * A depth/volume value of 0 represents the top of the lake, maximum values represent the bottom of the lake.
- * Every txt file following this convention should have a corresponding entry in the maximums txt file.

Expects that information about maximum lake depth (ft) and lake volume (acre-ft) adheres to the following conventions: *

- Information is in a single csv file (specified by "max_file") stored in the same directory as includes the individual txt files.
- * Every lake with a DataThief txt file should have an entry here
- * Columns include: "WBIC", "Depth_feet", and "Volume_acre_ft" (may include others as well, but unused here).
- * Missing values are denoted by NA (capitalized).
- * If there is a value for "Depth_feet", but "Volume_acre_ft" is NA, will use maximum depth plus the DataThief information to estimate what maximum volume is likely to be (and vice versa, if has maximum volume but maximum depth is NA).

Note that the returned data frame lists the lake volume (acre-ft) corresponding to lake depths such that 0ft is the lake bottom, 5ft is 5ft above the lake bottom, and the maximum depth value represents the surface of the lake. If the parameter "flip" is set to FALSE, the returned data frame instead retains the conventions in the DataThief txt files, where 0 values for depth and volume represent the lake surface and maximum values represent the bottom of the lake.

Value

a data frame with the following columns:

| | |
|----------------|--|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in csv filename (will be a single word, e.g. "easthorsehead", just to help with quick identification) |
| depth_feet | lake depth (ft) |
| volume_acre_ft | lake volume at this lake depth (acre-ft) |

convert_proportion_areas

Convert proportional area hypsography to areas in acres

Description

Given the path of a directory where csv files live, reads in information about depth (ft) vs. proportional area relationship, maximum areas, and converts to depth (ft) vs. area (acres) relationships.

Usage

```
convert_proportion_areas(path, max_area_file, flip = TRUE)
```

Arguments

| | |
|---------------|---|
| path | Path of directory containing all csv files with depth and proportional area info (extracted from bathymetry maps using imageJ), e.g. "data-raw/Wisconsin_Hypsography". See Details about expected format of these csv files. |
| max_area_file | Name of csv file with information about maximum areas of each lake, e.g. "WI_areas.csv". See Details about expected format of this csv file. |
| flip | Indicates whether should flip depths so that the maximum depth corresponds to the lake surface and a depth of zero corresponds to the lake bottom (TRUE) or keep as-is, with a depth of zero corresponding to the lake surface (FALSE). Defaults to TRUE to flip. |

Details

Expects csv files with depth vs. proportional area information to adhere to the following conventions: * All csv files are stored in the same directory (specified by "path") * Filenames are "singlelakenam_WBIC.csv", e.g. "easthorsehead_1523000.csv" * Columns are (in order): "depth_ft", "proportion_area" * A proportion area of "1" corresponds with a depth_ft of "0" and represents the maximum area as measured at the top of the lake. * Every csv file following this convention should have a corresponding entry in the maximum lake area csv file.

Expects that information about maximum lake areas (in acres) adheres to the following conventions: * Information is in a single csv file (specified by "max_area_file") stored in the same directory as includes the individual csv files. * Columns are (in order): "WBIC" and "Area_acres" * Every lake with a proportional area csv file should have an entry here

Note that the returned data frame lists the lake area (acres) corresponding to lake depths such that 0ft is the lake bottom, 5ft is 5ft above the the lake bottom, and the maximum depth value represents the surface of the lake. If the parameter "flip" is set to FALSE, the returned data frame instead retains the conventions in the proportional area csv files, where lake areas correspond to lake depth contours such that 0ft is the lake surface, 5ft is 5ft below the lake surface, and the maximum depth value represents the bottom of the lake.

Value

a data frame with the following columns:

| | |
|------------|--|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in csv filename (will be a single word, e.g. "easthorsehead", just to help with quick identification) |
| depth_ft | lake depth (ft) |
| area_acres | lake area at this lake depth (acres) |

depth_change_given_area_loss

Calculate change in lake depth with X percent loss of lake area

Description

Given a data frame with information about "WBIC", "depth_feet", and "area_acres" and what percentage area loss to assume, calculates the estimated change in lake depth from the maximum lake depth/area Assumes a linear change in depth and area between specified contour intervals in order to approximate lower lake depth.

Usage

```
depth_change_given_area_loss(df, pcnt_loss = 10)
```

Arguments

| | |
|-----------|---|
| df | data frame with information about "WBIC", "lake", "depth_feet", and "area_acres". Input data frame may have other columns, but must have these. |
| pcnt_loss | Specify what percentage loss of lake area from maximum lake area to evaluate. Defaults to 10 (percent). |

Value

data frame with the following columns:

| | |
|--------------|---|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in the input data frame. Typically something like "easthorsehead", just to help with quick identification) |
| max_area | maximum lake area (acres) |
| max_depth | lake depth corresponding to maximum lake area (ft) |
| lower_area | area assuming X pcnt loss (as input, default is 10 pcnt loss) (acres) |
| lower_depth | lake depth corresponding to lowered lake area (ft) |
| depth_change | change in lake depth corresponding to X pcnt loss (as input, default is 10 pcnt loss) in lake area (ft) |

```
depth_change_given_volume_loss
```

Calculate change in lake depth with X percent loss of lake volume

Description

Given a data frame with information about "WBIC", "depth_feet", and "volume_acre_ft" and what percentage volume loss to assume, calculates the estimated change in lake depth from the maximum lake depth/volume. Assumes a linear change in depth and volume between specified contour intervals in order to approximate lower lake depth.

Usage

```
depth_change_given_volume_loss(df, pcnt_loss = 10)
```

Arguments

| | |
|-----------|---|
| df | data frame with information about "WBIC", "lake", "depth_feet", and "volume_acre_ft". Input data frame may have other columns, but must have these. |
| pcnt_loss | Specify what percentage loss of lake volume from maximum lake volume to evaluate. Defaults to 10 (percent). |

Value

data frame with the following columns:

| | |
|--------------|---|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in the input data frame. Typically something like "easthorsehead", just to help with quick identification) |
| max_vol | maximum lake volume (acre-ft) |
| max_depth | lake depth corresponding to maximum lake volume (ft) |
| lower_vol | volume assuming X pcnt loss (as input, default is 10 pcnt loss) (acre-ft) |
| lower_depth | lake depth corresponding to lowered lake volume (ft) |
| depth_change | change in lake depth corresponding to X pcnt loss (as input, default is 10 pcnt loss) in lake volume (ft) |

volume_loss_given_depth_change

Calculate percent loss of lake volume with Xft change in lake depth

Description

Given a data frame with information about "WBIC", "depth_feet", and "volume_acre_ft" and what reduction in max depth (ft) to assume, calculates the estimated change in lake volume (Assumes a linear change in depth and volume between specified contour intervals in order to approximate lower lake volume.

Usage

```
volume_loss_given_depth_change(df, depth_change_ft = 1)
```

Arguments

| | |
|-----------------|---|
| df | data frame with information about "WBIC", "lake", "depth_feet", and "volume_acre_ft". Input data frame may have other columns, but must have these. |
| depth_change_ft | Specify what reduction in lake depth from maximum lake depth to evaluate. Defaults to 1 (ft). |

Value

data frame with the following columns:

| | |
|---------------|---|
| WBIC | Wisconsin Water Body Identification Code (WBIC) of lake |
| lake | name of lake as included in the input data frame. Typically something like "easthorsehead", just to help with quick identification) |
| max_depth | maximum lake depth (ft) |
| max_vol | lake volume corresponding to maximum lake depth (acre-ft) |
| lower_depth | lake depth assuming Xft reduction (as input, default is 1ft reduction) (ft) |
| lower_vol | volume corresponding to lowered depth (acre-ft) |
| vol_pcmt_loss | percentage change in lake volume relative to maximum lake volume given a Xft reduction in lake depth (as input, default is 1ft reduction) |

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