Fuel wood - Flow

General description

Not all forests can be managed equally: accessibility (infrastructure) and technical feasibility (due to topography) play a crucial role in sustainable forest management. Hence, this indicator reflects the timber removals for fuel wood production considering both the forest accessibility (based on the OSM layer) and topographical site condition (slope angle from DEM). Data for timber removals are taken from national forestry inventories. **Flowchart below** describes in detail the calculation procedure to derive the amount of fuelwood (m³/ha/year) produced per local administrative units (LAU2) of the Alpine Space.

The procedure consists of two main parts:

- **Calculation of the accessible forest areas (Step 1 and 2):** typically, commercial wood production occurs only on forests that are accessible and workable in terms of topographic conditions. Hence, in the following analysis only accessible and workable forest areas are included.
- **Calculation of the amount of fuelwood produced in each LAU2 (Step 3 and 4**): The statistical data about the amount of felling is disaggregated at LAU2 level using results from part 1.

Input data

GIS-Data

- **Forest roads:** open street map layer (OSM)

Source: http://download.geofabrik.de/. The roads classified as “bridleway”, “service”, “track”, “track_grade1”, “track_grade2”, “track_grade3”, “track_grade4”, “track_grade5”, “unclassified” and “unknown” are used.

- **Forest**: High-resolution tree-cover-density layer

Source**: http://land.copernicus.eu/.** Pixels with a density between 30-100% are used; forest in agricultural and urban areas is removed.

- **Digital Elevation Model:** Elevation raster dataset

Source:**http://land.copernicus.eu,**v1.0

- **LAU2 layer:** Boundaries of the local administrative units

Source: **http://www.eurogeographics.org/products-and-services/euroboundarymap;** version 10.

- **Region layer:**Boundaries of the areas for which the statistical data is available.Statistical data about the amount of felled wood is typically not

available at LAU level; hence, for every country we used the finest available resource. Because these datasets have different resolutions and names, we call them “region layers” in the following description. The original names/resolutions for the different countries are the following:

-Germany: Growing regions

Source: https://gdi.thuenen.de/wo/wgwb/

-Switzerland: Production regions*

-France: Nuts 2

Source: http://www.eurogeographics.org/products-and-services/euroboundarymap

-Italy: Nuts 2

Source:http://www.eurogeographics.org/products-and-services/euroboundarymap

-Liechtenstein: Nuts 2

Source: http://www.eurogeographics.org/products-and-services/euroboundarymap

-Austria: “Bezirke”

Source: http://data.opendataportal.at/dataset/geojson-daten-osterreich

-Slovenia: Forest regions (dataset provided by the Slovenian Forest Institute)

Statistical data:

- **Statistical data about roundwood production**: The amount of wood that is extracted from the forest.

Source: Forest inventories of single countries

- Percentage of roundwood transformed into fuelwood

Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Wood_products_-_production_and_trade

Variables:

- Maximum access distance = **200m (after Clouet, N. and Berger, F., 2009)**

Calculation processes

(1) Calculation of the slope angle of accessible forest: Forested areas within the maximum access distance from forest roads are extracted from the original forest layer and their slope is calculated (in %) The 200m serve as a threshold, all pixels that are further away from the street are not considered in the following calculation.

(2) Calculation of access distance: Based on Clouet & Berger (2009), the maximum distance from which every pixel (extracted in Step 1) can be accessed, due to its topographic conditions, is calculated. The access distance of a pixel can be lower than the actual distance from the street and therefore, all pixels that are further away from the road than their access distance are removed.

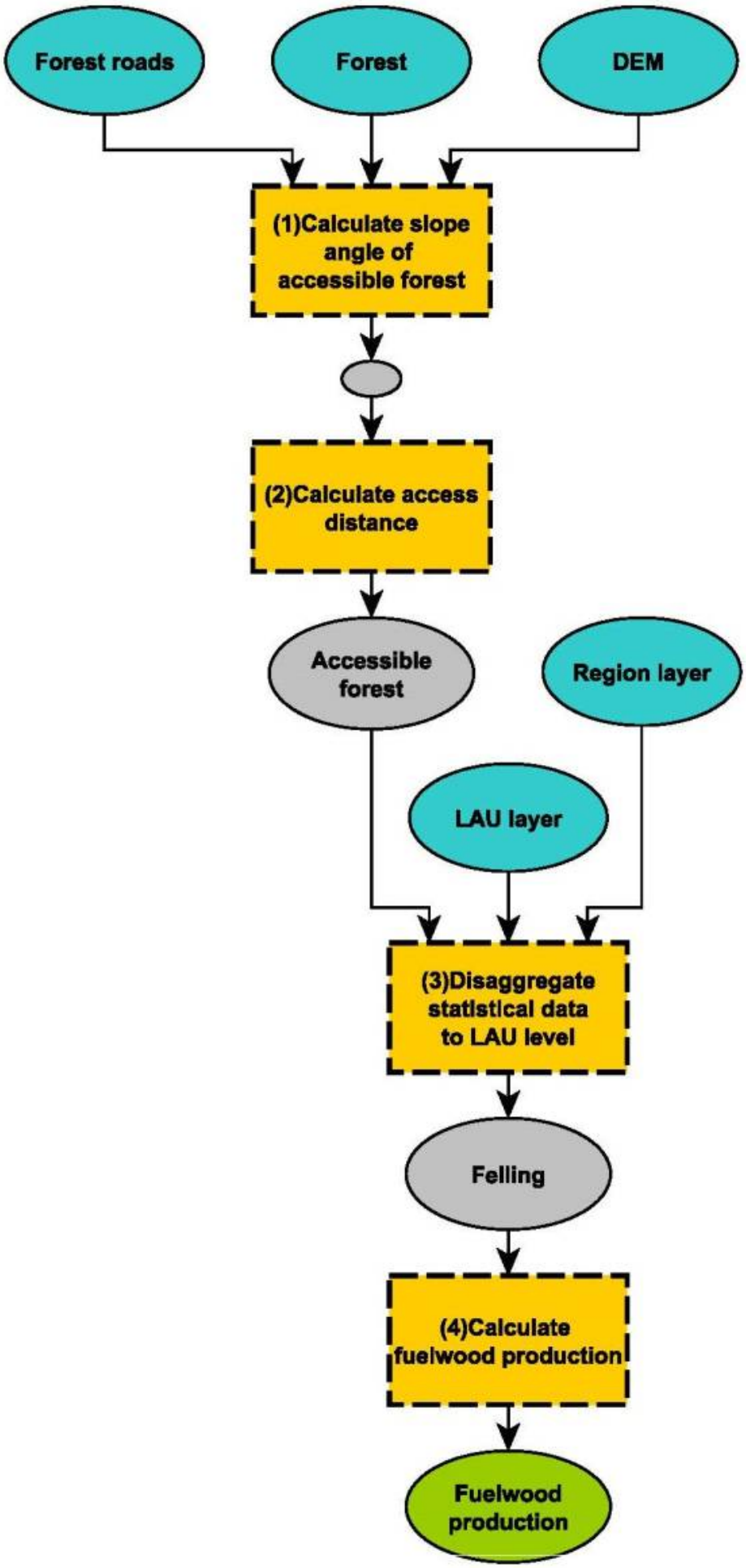
(3) Disaggregation of statistical data to LAU2 level: The data about the production of roundwood is disaggregated to LAU2 level via the share of accessible forest in every LAU2.

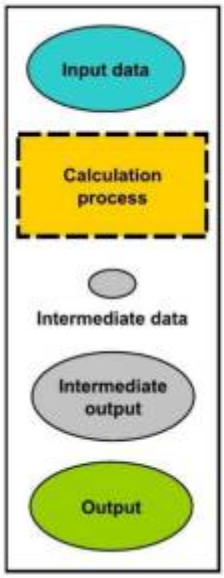
statistical data about fellings/accessible forest in region = average fellings per unit of accessible forest

*average felling*accessible forest in LAU= LAU fellings*

Dividing the statistical data by the accessible forest area in each region gives an average value of the produced roundwood per accessible forest for each region. For all LAUs in the region, this average value is multiplied with the total accessible forest area of the LAU2. The result is the amount of roundwood that is produced in the LAU2.

(4) Calculation of fuelwood production: With statistical data about the share of roundwood that is transformed into fuelwood, the amount of fuelwood that is produced in every LAU2 is estimated.


Forest roads
Forest
DEM
(1)Calculate slope angle of accessible forest
(2)Calculate access distance
Accessible forest
Region layer
LAU layer
(3)Disaggregate statistical data to LAU level
Felling
(4)Calculate fuelwood production
Fuelwood production



Input data→elements that hold a value or a reference to data stored on disk. It is usually a spatial explicit information coming from official sources.

Calculation process→ the actual operation performed on the data. The number preceding the item refers to the number in the model description.

Intermediate data→ for each calculation process intermediate data is generated. This data, however, is usually not significant itself, but is used as an input for the next calculation step.

Intermediate output→ is intermediate data that has a significance for the ES evaluation.

Output→ is the result of the calculation process. It is typically one of the ES indicators, either Supply, Demand or Flow.

References:

Clouet, N.; Berger, F. (2009): Modélisation des surfaces débardables au tracteur forestier en zone de montagne. SIG 2009. Confeérence Francophone ESRI