

Regionalisation in openLCA

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greendelta
sustainability consulting + software

Regionalisation in openLCA

Content

- 1) Flow-based regionalisation
- 2) Geospatial-based regionalisation
- 3) Concluding remarks



Regionalisation in openLCA

Flow-based regionalisation

- *openLCA LCIA methods v2*
- Individual elementary flows for specific regions (e.g. countries)
- AWARE
- ILCD 2011 Midpoint+

The screenshot shows the openLCA 1.7.2 software interface. On the left, the navigation tree displays various LCIA methods, with 'Impact assessment methods' expanded to show 'AWARE', 'BEES', 'BEES+', 'Berger et al 2014 (Water Scarcity)', 'Boulay et al 2011 (Human Health)', 'Boulay et al 2011 (Water Scarcity)', 'CML 1992', 'CML 2001 (all impact categories)', 'CML 2 baseline 2000', 'CML-IA baseline', 'CML-IA non-baseline', 'Cumulative Energy Demand', 'Cumulative Exergy Demand', 'Eco-indicator 95', 'Eco-indicator 99 (E)', 'Eco-indicator 99 (H)', 'Eco-indicator 99 (I)', 'Ecological footprint', 'Ecological Scarcity 2006', 'Ecological Scarcity 2006 (Water Scarcity)', 'Ecological Scarcity 2013', 'Ecopoints 97 (CH)', 'Ecosystem Damage Potential', 'EDIP/UMIP 97', 'EDIP/UMIP 97 (resources only)', and 'EDIP 2003'. On the right, a table titled 'AWARE' lists regionalized flows for China. A red arrow points to the entry for 'Water, CN' (Emission to water/ocean). The background features a map of China with regions highlighted in yellow.

Flow	Description	Volume
F Water, BZ	Emission to water/ocean	Volume
F Water, BZ	Emission to water/unspecified	Volume
F Water, CA	Emission to water/ocean	Volume
F Water, CA	Emission to water/unspecified	Volume
F Water, CC	Emission to water/unspecified	Volume
F Water, CD	Emission to water/ocean	Volume
F Water, CD	Emission to water/unspecified	Volume
F Water, CF	Emission to water/ocean	Volume
F Water, CF	Emission to water/unspecified	Volume
F Water, CG	Emission to water/ocean	Volume
F Water, CG	Emission to water/unspecified	Volume
F Water, CH	Emission to water/ocean	Volume
F Water, CH	Emission to water/river	Volume
F Water, CH	Emission to water/unspecified	Volume
F Water, CI	Emission to water/ocean	Volume
F Water, CI	Emission to water/unspecified	Volume
F Water, CK	Emission to water/unspecified	Volume
F Water, CL	Emission to water/ocean	Volume
F Water, CL	Emission to water/unspecified	Volume
F Water, CM	Emission to water/ocean	Volume
F Water, CM	Emission to water/unspecified	Volume
F Water, CN	Emission to water/ocean	Volume
F Water, CN	Emission to water/unspecified	Volume
F Water, CO	Emission to water/ocean	Volume
F Water, CO	Emission to water/unspecified	Volume
F Water, cooling, unsp...	Resource/in water	Volume
F Water, cooling, unsp...	Resource/unspecified	Volume

Regionalisation in openLCA

Flow-based regionalisation

Subgroup by processes Cut-off %

Name	Category	Inventory result	Impact factor	Impact result	Unit
Water use - AWARE				11.81453	m3
irrigation CN	Agricultural / Transformation			24.95496	m3
Water, river, CN	Resource / unspecified	0.41340 m3	42.40000 m3/m3	17.52836	m3
Water, well, in ground, CN	Resource / unspecified	0.17516 m3	42.40000 m3/m3	7.42659	m3
rice production CN	0_rice case foreground / CN			-13.14502	m3
Water, CN	Emission to water / unspecified	0.31002 m3	-42.40000 m3/m3	-13.14502	m3

Regionalisation in openLCA

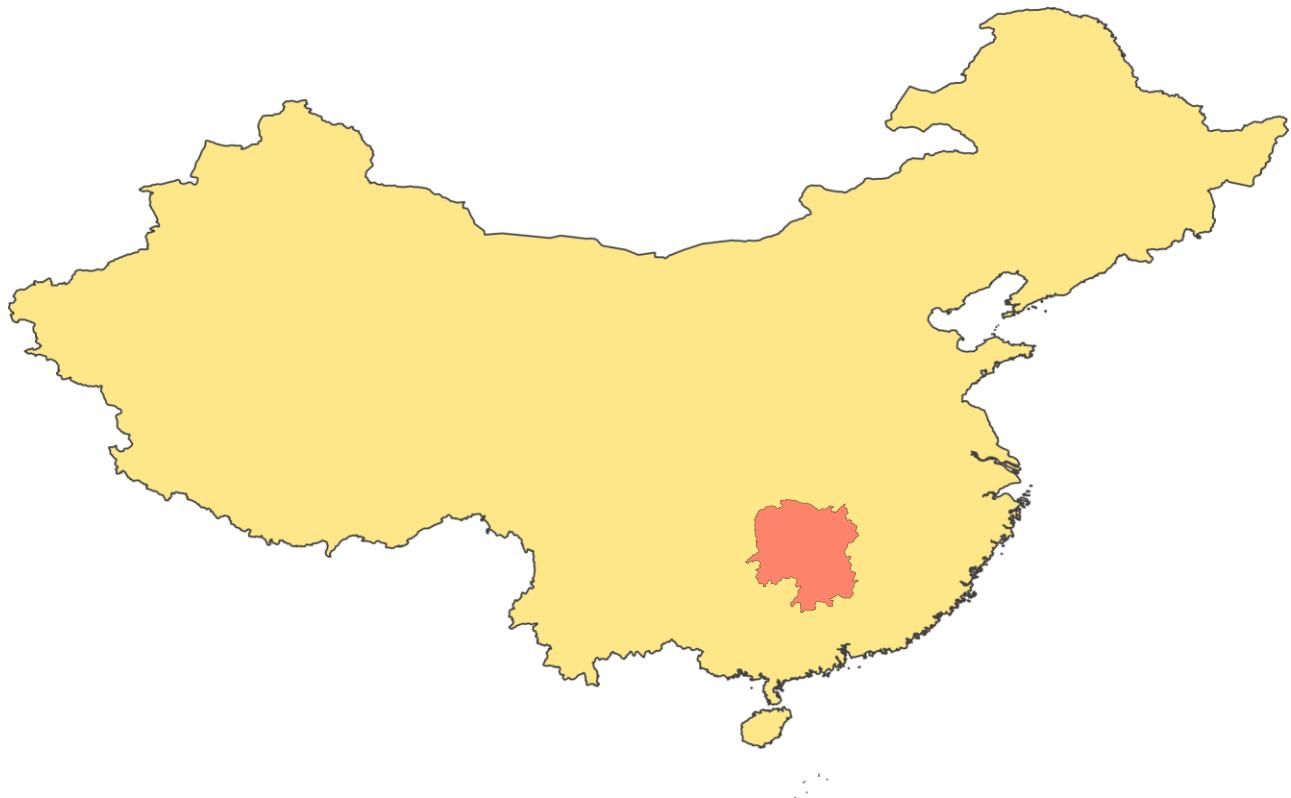
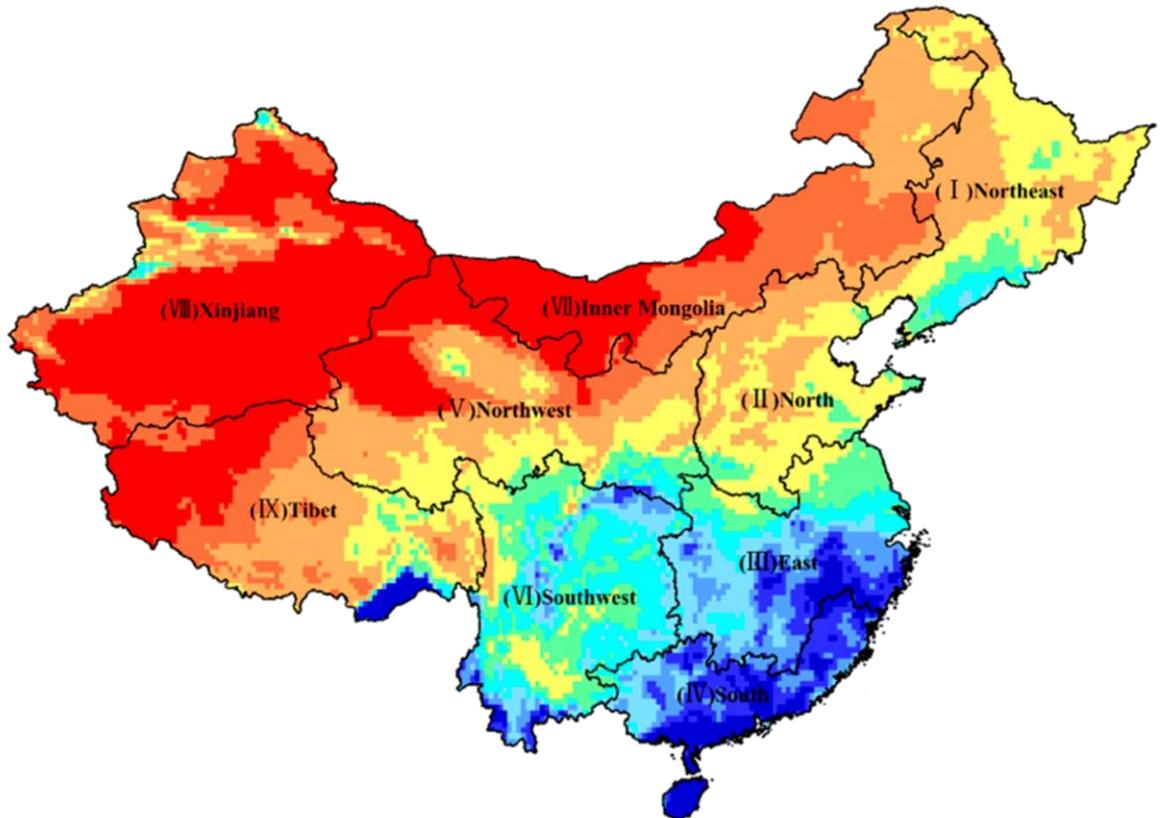
Content

- 1) Flow-based regionalisation
- 2) Geospatial-based regionalisation
- 3) Concluding remarks



Regionalisation in openLCA

Why Geospatial-based regionalisation?

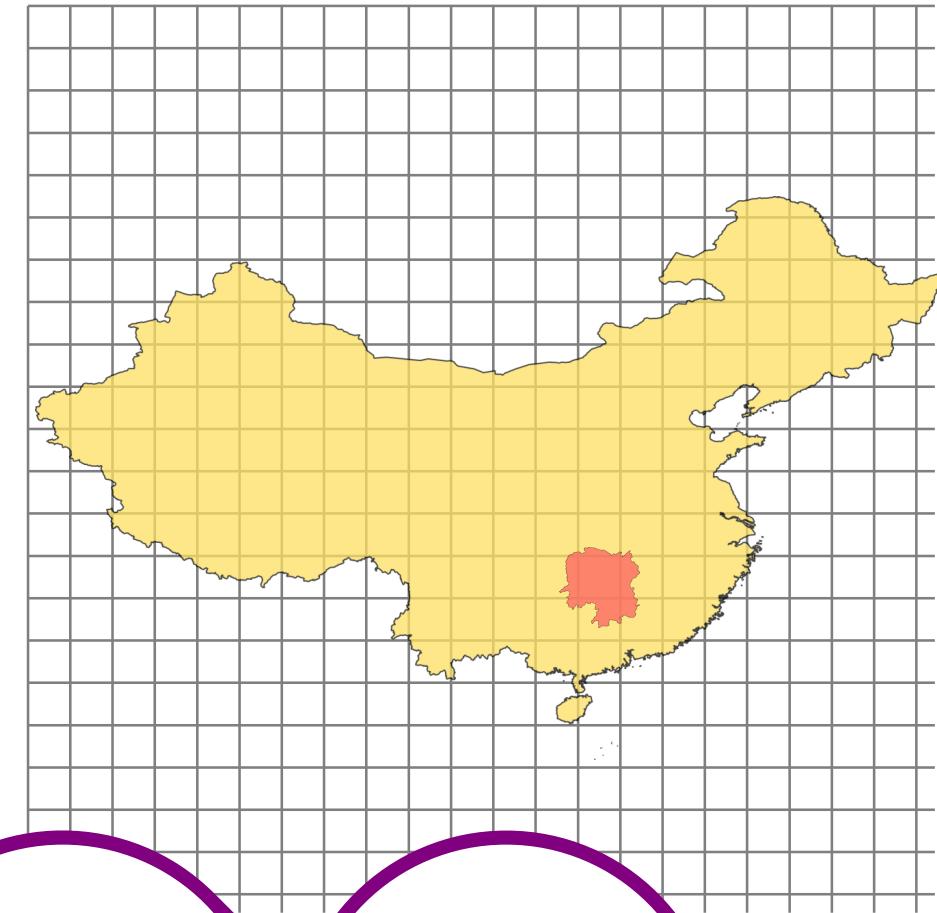
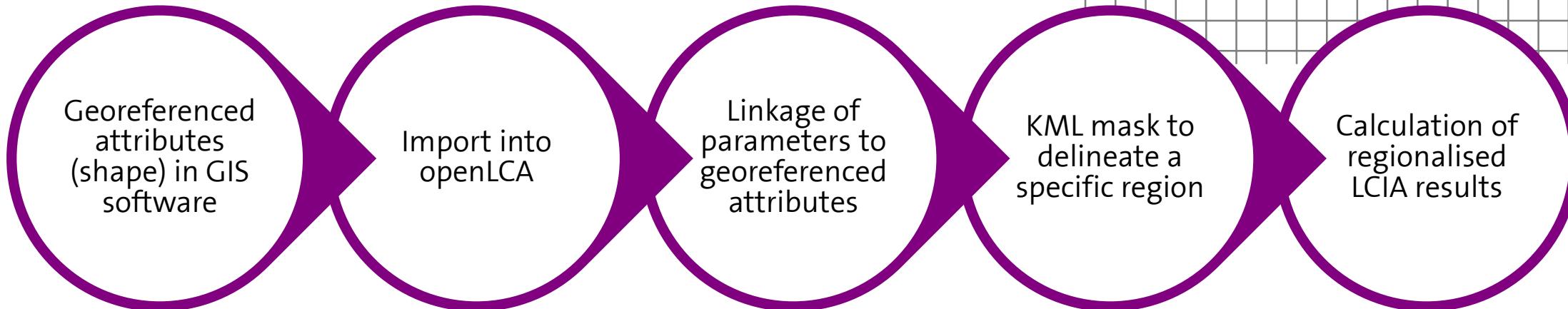


Source: <http://www.mdpi.com/2073-4433/9/3/104> (12.09.2018)

Regionalisation in openLCA

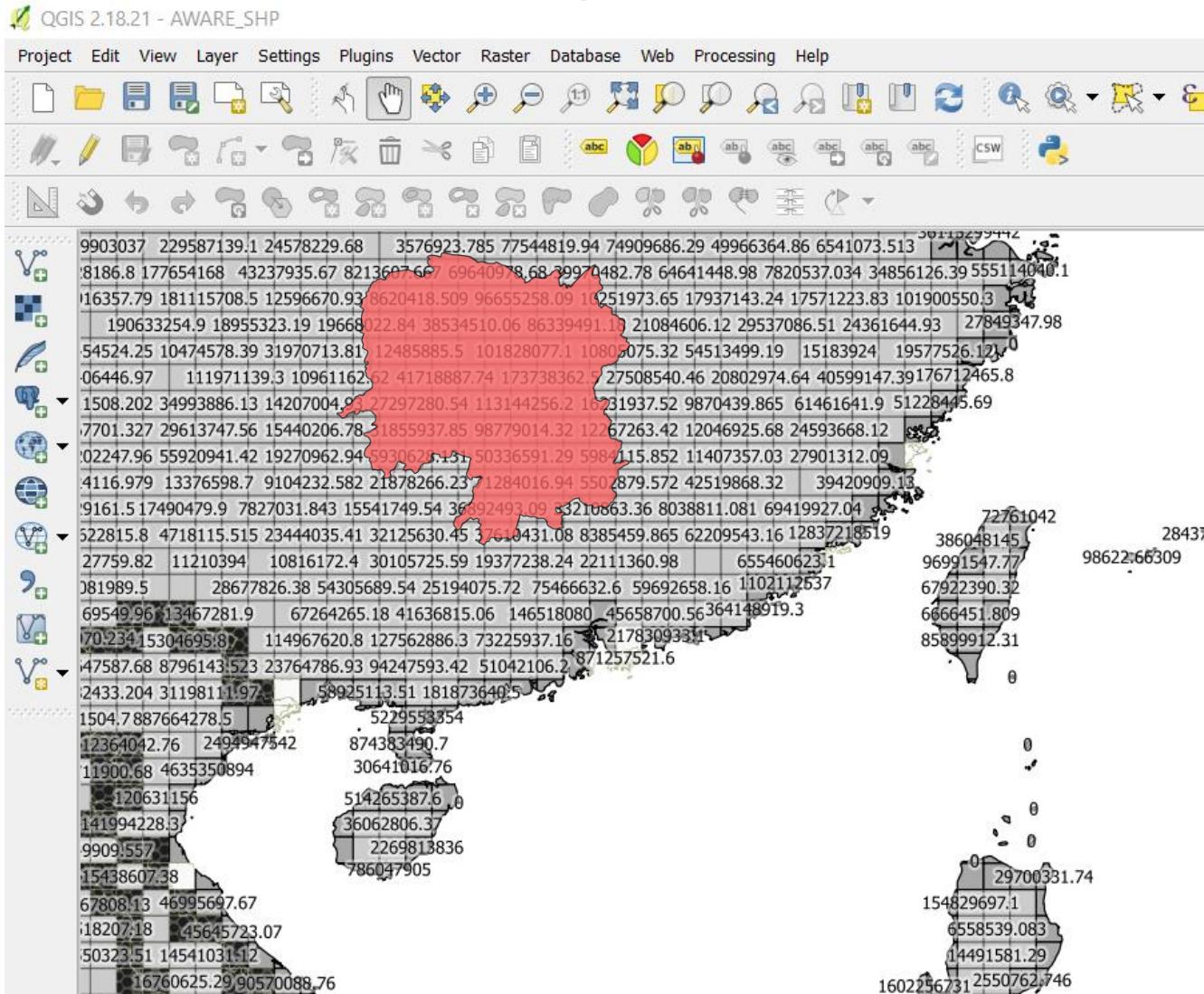
Geospatial-based regionalisation

- Shape (*.shp) in Geographic Information Systems (GIS) software e.g. QGIS or ArcGIS for background data
- Preparation of Keyhole Markup Language (*.kml) file as a mask to regionalise a LCA



Regionalisation in openLCA

Geospatial-based regionalisation



openLCA 1.7.2

Navigation: aware_2018_mar

- Projects
- Product systems
- Processes
- Flows
- Indicators and parameters
 - Impact assessment methods
 - AWARE_MAR_2018
 - Social indicators
 - Global parameters
 - Data quality systems
- Background data
 - Flow properties
 - Unit groups
 - Currencies
 - Actors
 - Sources
- Locations
 - Afghanistan
 - Africa
 - AI producing Area 2, North
 - Acrotiri Sovereign Base Area
 - Al Andalus
 - Alaska Systems Coordinating
 - Albania
 - Algeria
 - AI producing Area 1, Africa
 - AI producing Area 2, North
 - AI producing Area 3, South
 - AI producing Area 4, East As
 - AI producing Area 5, South
 - AI producing Area 6A, West
 - AI producing Area 6B, East/
 - AI producing Area 8, Gulf-Al
 - Aluminium producing area,
 - Aluminium producing area,
 - American Samoa
 - Americas
 - Andorra

Shape files (beta): AWARE_MAR_2018

Parameter aggregation function

Function Arithmetic mean

Files

Location C:\LCA-data\datasets\aware_2018_mar\olca_\cia_methods\c6f2a19a-7d8b-4...

Parameters - AWARE_SHP

General information | Impact factors | Normalization and weighting | Parameters | Shape files (beta)

Version 03 August 2017

Regionalisation in openLCA

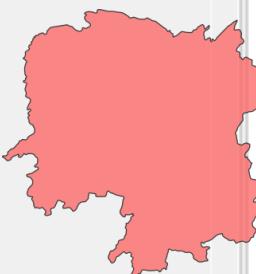
Geospatial-based regionalisation

LCA openLCA 1.7.2

File Database Window Help

Navigation

- CN
 - P rice production CN
 - P white rice, at supermarket/kg/CN
 - P white rice, from dry milling, at plant/kg/CN
 - P white rice, packed, at plant/kg/CN
 - P white rice cooked, at household/CN U
- IN
- US/CH
- Agricultural
- Air
- Biomass
- Biowaste
- Building equipment
- Ceramics
- Chemicals
- Cogeneration
- Compressed air
- Construction
- Construction waste
- Electricity
- Electricity by fuel
- Electricity country mix
- Electronics
- Electronics waste
- Fuels
- Glass
- Heat
- Incineration
- Intermodal
- Landfarming
- Landfill
- Land transformation
- Mechanical
- Minerals



P General information: irrigation CN

General information

Name	irrigation CN
Description	Inventory refers to the production edited, because they are country
Category	Agricultural > Transformation
Version	00.00.001
UUID	4586b23f-ec87-345b-b0e5-b040
Last change	
Infrastructure process	<input type="checkbox"/>
Create product system	

Time

Start date	11/09/2018
End date	11/09/2018
Description	Unspecified

Geography

Location	China - Hunan
KML	Polygon [109.26,28.51 .. 109.26,28.51]

LCA openLCA 1.7.2

File Database Window Help

Navigation

- aware_2018_mar
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 - Al producing Area 1, Africa
 - Al producing Area 2, North
 - Al producing Area 3, South
 - Al producing Area 4, East Asia
 - Al producing Area 5, South
 - Al producing Area 6A, West
 - Al producing Area 6B, East/SEA
 - Al producing Area 8, Gulf-Al
 - Aluminium producing area
 - Aluminium producing area
 - American Samoa
 - Americas
 - Andorra

Welcome AWARE_MAR_2018

Parameters: AWARE_MAR_2018

Global parameters

Input parameters

Name	Value	Uncertainty	Description	External source
agri	45.74	uniform: min=-1.00E11 max=9.85E1	from shapefile: openLCA_INPUT6_m1	AWARE_SHP
cons_irri	1.978485385E9	uniform: min=0.00 max=3.96E9	from shapefile: AWARE_SHP	AWARE_SHP
cons_nonir	1.242608837E9	uniform: min=0.00 max=2.49E9	from shapefile: AWARE_SHP	AWARE_SHP
cons_tot	2.744698942E9	uniform: min=0.00 max=5.49E9	from shapefile: AWARE_SHP	AWARE_SHP
m1_irri	1.97849E11	uniform: min=0.00 max=3.96E11	from shapefile: AWARE_SHP	AWARE_SHP
m1_nonirri	1.24261E11	uniform: min=0.00 max=2.49E11	from shapefile: AWARE_SHP	AWARE_SHP
m1_tot	2.7447E11	uniform: min=0.00 max=5.49E11	from shapefile: AWARE_SHP	AWARE_SHP
non_agri	20.3	uniform: min=-1.00E11 max=1.00E2	from shapefile: openLCA_INPUT6_m1	AWARE_SHP
unknown	42.95	uniform: min=-1.00E11 max=1.00E2	from shapefile: openLCA_INPUT6_m1	AWARE_SHP
yr_irri	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP
yr_nonirri	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP
yr_tot	-4.99999999495E10	uniform: min=-1.00E11 max=1.00E2	from shapefile: AWARE_SHP	AWARE_SHP

Dependent parameters

Name	Formula	Value	Description
CF_irri	m1_irri/cons_irri	100.0007386952068	
CF_irri_alt	if(cons_irri=0;0;if(yr_irri=0;0;if(abs((m1_irri/cons_irri)-yr_irri)<0.01;yr_irri;0);if(cons_irri<=0.0000000000000001;0;1);1);1)	-4.9999999495E10	
CF_nonirri	m1_nonirri/cons_nonir	100.0009359341132	
CF_nonirri_alt	if(cons_nonir=0;0;if(yr_nonirri=0;0;if(abs((m1_nonirri/cons_nonir)-yr_nonirri)<0.01;yr_nonirri;0);if(cons_nonir<=0.0000000000000001;0;1);1);1)	-4.9999999495E10	
CF_tot	m1_tot/cons_tot	100.0003854703274	
CF_tot_alt	if(cons_tot=0;0;if(yr_tot=0;0;if(abs((m1_tot/cons_tot)-yr_tot)<0.01;yr_tot;0);if(cons_tot<=0.0000000000000001;0;1);1);1)	-4.9999999495E10	

General information Impact factors Normalization and weighting Parameters Shape files (beta)

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Regionalisation in openLCA

Geospatial-based regionalisation

General information: China - Hunan

Code: CN-Hunan
Longitude: 0.0
Latitude: 0.0

KML Editor

Map Text

Navigation: aware_2018_mar

- Projects
- Product systems
 - Belgium
 - Switzerland
- Processes
 - P Switzerland - CH
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 - AI producing Area 4, East As
 - AI producing Area 5, South
 - AI producing Area 6A, West
 - AI producing Area 6B, East/
 - AI producing Area 8, Gulf-Al
 - Aluminium producing area
 - Aluminium producing area

openLCA 1.7.2

File Database Window Help

Navigation: aware_2018_mar

Welcome AWARE_MAR_2018 P Switzerland - CH Switzerland

General information: Switzerland

General information

Name: Switzerland
Description: First created: 2018
Version: 00.00.000
UUID: f9e1f7d3-57d7-45

Calculation properties

Please select the properties for the calculation

Allocation method: None
Impact assessment method: AWARE_MAR_2018
Normalization and weighting set:
Calculation type: Quick results, Analysis, Regionalized LCIA, Monte Carlo Simulation
 Include cost calculation
 Assess data quality

Reference

Process: P Switzerland
Product: F AWARE Out
Flow property: M Mass
Unit: kg
Target amount: 1.0

< Back Next > Finish Cancel

General information Parameters Model graph Statistics HTML Graph

Regionalisation in openLCA

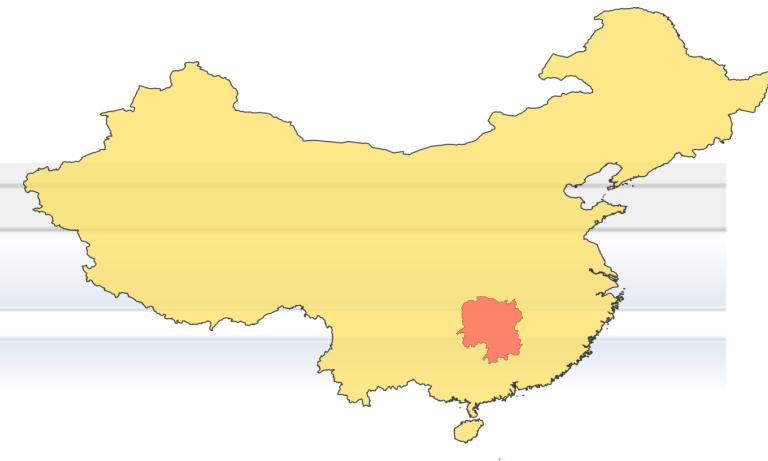
Geospatial-based regionalisation

white rice cooked, at household/CN U Regionalized LCIA result

Impact analysis: white rice cooked, at household/CN U

Impact analysis

Subgroup by processes Cut-off 1 %

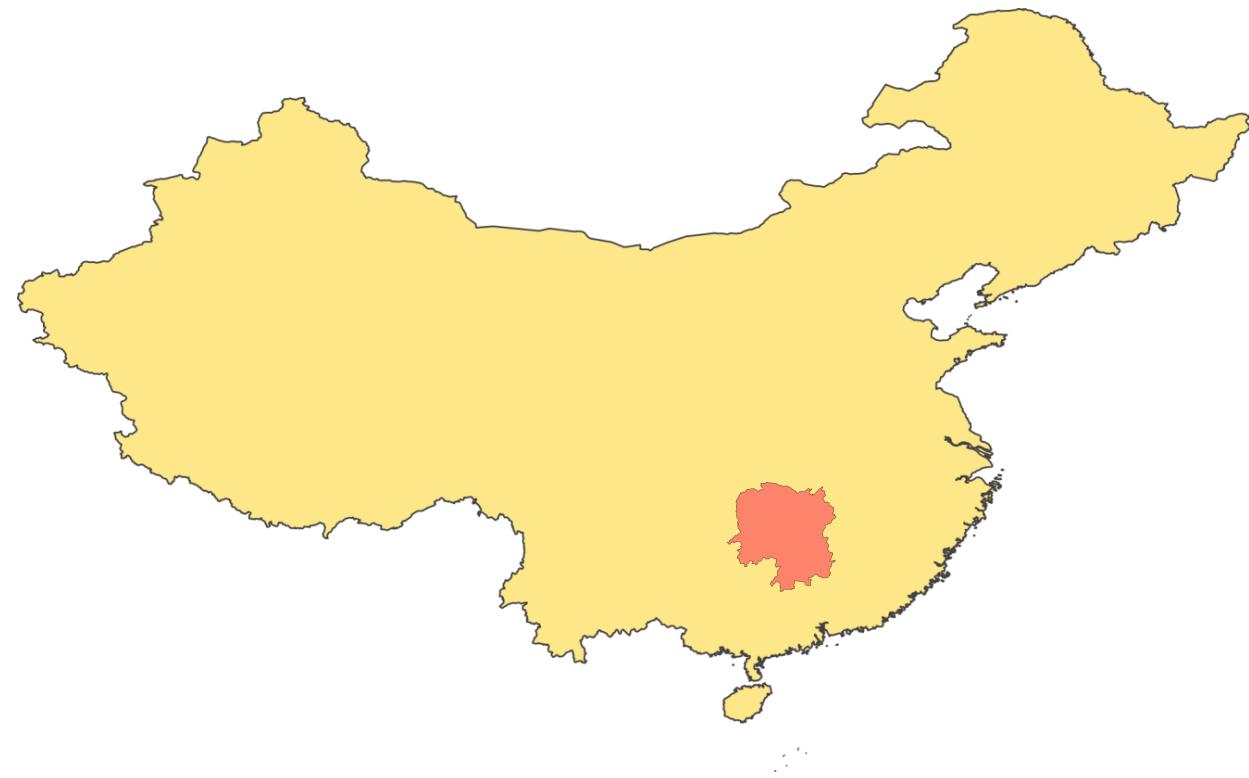


Name	Category	Inventory result	Impact factor	Impact result	Unit
Water use (Midpoint, per watershed, weighting by consumption)				0.24088	m3
irrigation CN - CN-Hunan	Agricultural / Transformation			0.23810	m3
F Water, river	Resource / in water	0.41340 m3	0.40454 m3/m3	0.16724	m3
F Water, well, in ground	Resource / in water	0.17516 m3	0.40454 m3/m3	0.07086	m3
Water use (Midpoint, per country, pre-defined factors)				25.26826	m3
irrigation CN - CN-Hunan	Agricultural / Transformation			25.27866	m3
F Water, river	Resource / in water	0.41340 m3	42.95000 m3/m3	17.75573	m3
F Water, well, in ground	Resource / in water	0.17516 m3	42.95000 m3/m3	7.52293	m3

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Regionalisation in openLCA

Flow-based regionalisation

- Requires regionalised elementary flows (impact factors)
- Based on existing technique (*mature – but limited?*)
- Amount of required flows escalates
- Inadequate for high-resolution regionalisation?

Geospatial-based regionalisation

- Requires geospatial data
- Novel approach (*beta*)
 - *Current best practice example in openLCA: AWARE*
- Synergies with other georeferenced data sets?
 - NASA's Socioeconomic Data and Applications Center (SEDAC)
 - UNEP Environmental Data Explorer
 - FAO GeoNetwork

Thank You for Your Attention!

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