LANDGRIFFON

LANDGRIFFON METHODOLOGY EXECUTIVE SUMMARY.

Agricultural supply chain impact and risk assessment.

Version 0.1

September, 2022

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INTRODUCTION

LandGriffon is a software service that helps companies assess risks and impacts from agricultural production in their supply chains and analyze possible futures.

LandGriffon uses satellite data and modeling approaches to spatialize company supply chain information to enable companies to take action now with the information they have. As LandGriffon provides a holistic picture of company agricultural supply chain impacts, companies can answer questions such as:

- *What materials, business units, regions or suppliers are the largest sources of impacts and risks?*
- *Where are the greatest opportunities to reduce impacts and risks?*
- *Are we making progress against our targets and is this progress likely to be sufficient to achieve those targets?*

Every company has unique aspirations, environmental reporting needs, and supply chain visibility. LandGriffon provides a flexible framework with a baseline set of indicators that can be customized for individual companies and can evolve over time.

Though LandGriffon is a commercial service, the LandGriffon methodology and software source code are published openly in order to foster trust, collaboration, and continued innovation.

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WHAT COMPANY SUPPLY CHAIN INFORMATION DOES LANDGRIFFON USE?

LandGriffon users import company data on the agricultural materials they use in order to estimate their impacts. At a minimum, LandGriffon requires data on the amount of each material. More precise information about where materials are sourced from, such as the country, administrative region, or the point of production, enable LandGriffon to generate more accurate estimates of environmental impacts. Users can also include information about business units and other relevant company data to enhance their analysis (**Figure 1**).

When exact production locations are not known, LandGriffon models the likely locations using maps of agricultural crops and livestock production[1]. Providing more detailed location information increases the accuracy of the model. For example, if a company knows the country its crop is grown in, LandGriffon only looks at crop-producing areas in that country. If they know the country in which they received delivery, LandGriffon uses international trade data[2] to estimate the likely source (**Figure 2**).

The LandGriffon software can be deployed within corporate infrastructure so that sensitive data does not leave the corporate network.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Material	**Business unit**	**Suppliers**		**Sourcing location**					**Tonnage**				
Material	The business unit for which these materials were supplied	The company from which the materials were purchased	The company that produced the raw materials. (farm, cooperative, local aggregator etc.)	The level on information you have on where the raw materials were produced. One of: - Point of production (farm, ranch, plantation, etc.) - Aggregation point (warehouse, silo, mill etc.) - Country of production - Unknown	The country where the material was produced. If unknown, enter the country where the material was delivered.	Location of the producer. State, province, county, district, city, town, address etc. Leave blank if GPS coordinates are known. This will be geocoded with Google Maps.	GPS coordinates of producer, if known	GPS coordinates of producer, if known	Metric tonnes of the material purchased each year				
Material	Business unit	Tier 1 Supplier	Producer	Location Type	Country	Address	Latitude (°N)	Longitude (°E)	2010 tons	2011 tons	2012 tons	2013 tons	2014 tons
40 Rubber and	Accessories	Cargill	Moll	Unknown	Lebanon				2400	2424	2448	2472	2497
40 Rubber and	Accessories		Moll	Unknown	Malaysia				1300	1313	1326	1339	1352
40 Rubber and	Accessories		Moll	Unknown	United States of /				1000	1010	1020	1030	1040
40 Rubber and	Accessories		Moll	Unknown	Japan				730	737	744	751	759
40 Rubber and	Accessories		Moll	Unknown	India				490	495	500	505	510
40 Rubber and	Accessories		Moll	Country of production	Thailand				3100	3131	3162	3194	3226
40 Rubber and	Accessories		Moll	Country of production	Indonesia				2600	2626	2652	2679	2706
40 Rubber and	Accessories		Moll	Country of production	Cote D'Ivoire				1100	1111	1122	1133	1144
40 Rubber and	Accessories		Moll	Country of production	Vietnam				810	818	826	834	842
40 Rubber and	Accessories		Moll	Country of production	Malaysia				740	747	754	762	770
40 Rubber and	Accessories			Aggregation point (warehouse,	Liberia	Margibi			2300	2323	2346	2369	2393
40 Rubber and	...s			Aggregation point (warehouse, si	India	Kerala			1200	1212	1224	1236	1248
40 Rubber and	...s			Aggregation point (warehouse,	Thailand	Nakhon Si Thammarat			1000	1010	1020	1030	1040

__Figure 1.__ Example spreadsheet of company sourcing data for LandGriffon. Users may choose to include materials, suppliers, the information they have about where materials are produced, and the volume of materials sourced each year.

[1] MapSPAM 2010 v2 (IFPRI 2019); Gridded Livestock of the World v3, 2010 (Gilbert et al. 2018

[2] Resourcetrade.earth (Chatham House, 2021); FAOSTAT (FAO, 2022)

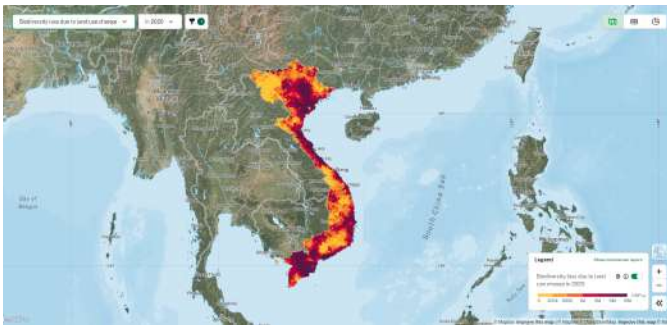
Sourcing location type	Modeled likely production areas

Aggregation point

Produced within 50km of this location

Producer country or jurisdiction

Produced within this country or jurisdiction



Delivery country

Produced within or imported to this country

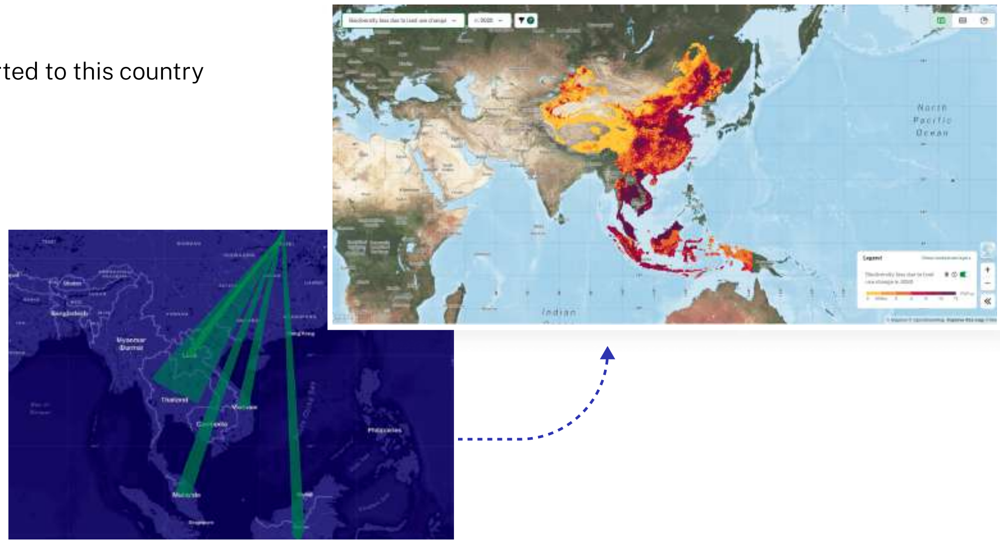


Figure 2. *Company supply chain location information is turned into heat maps of where materials are most likely to have been produced. The method used for mapping these locations depends on the type of location provided by users.*

HOW DOES LANDGRIFFON MEASURE ENVIRONMENTAL IMPACTS?

LandGriffon calculates indicators of environmental impacts such as the water use, land use, deforestation, greenhouse gas emissions, and biodiversity loss associated with agricultural production.

These indicators are calculated by combining company sourcing data with global environmental datasets (**Table 1**). LandGriffon calculates indicators per ton, and then multiplies by the total tonnage of each material sourced from each location across the entire company supply chain. The method used depends on the precision of the location data provided by the company and whether the indicator measures impacts occurring within current farmland (*farm level impacts*) or across the wider landscape (*landscape level impacts*).

To calculate farm-level indicators

If the exact point of production is provided, the indicator is based on the value of the indicator dataset(s) at that point. If the location information is less precise, LandGriffon calculates an average indicator value across the modeled likely areas of production (**Figure 2**).

More material is assumed to be sourced from locations with higher production, so impacts or risks in those areas are considered to be greater.

To calculate landscape-level indicators

LandGriffon additionally includes the risk of impacts to surrounding areas when calculating landscape level indicators, using a default radius of 50km. This accounts for deforestation or habitat conversion in areas nearby to historical producing regions that may be caused directly or indirectly by demand for materials. For example, if a company sources palm oil from a plantation in Aceh, Indonesia, the landscape-level deforestation risk indicator would be based on the area of forest loss occurring within a 50km radius of the plantation location.

HOW CAN USERS BENEFIT FROM LANDGRIFFON’S ANALYSIS AND FORECASTING FUNCTIONALITIES?

LandGriffon performs impact calculations automatically on imported data. We provide tools for visual and quantitative analysis, to export data, and to create forecasts or future scenarios simulating changes in procurement and impacts (**Figure 3**).

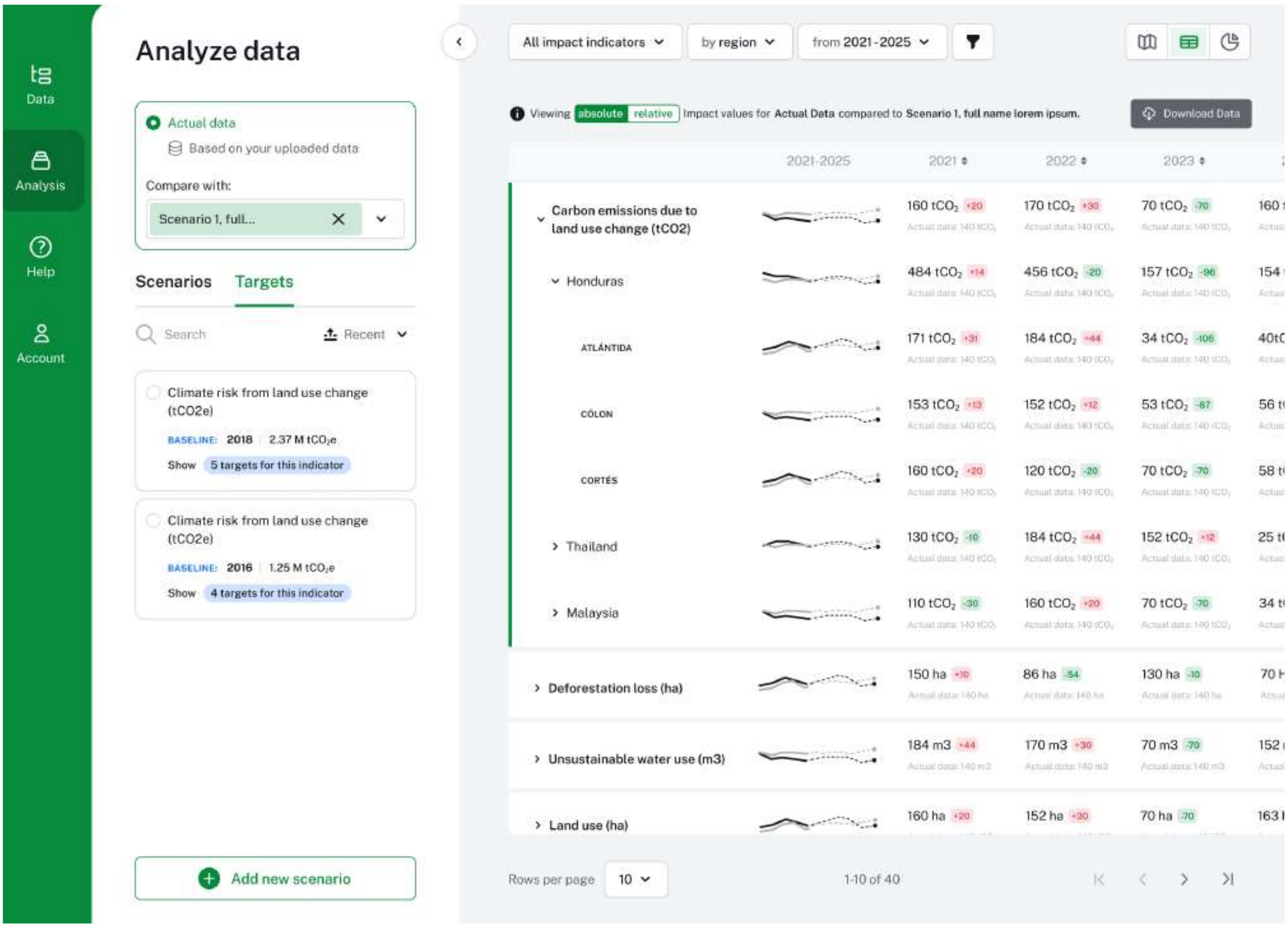


__Figure 3.__ Example table showing historical and forecasted impacts by region. Maps, charts, and data can be customized, filtered, and exported for further analysis.

Users can define future scenarios through a combination of *growth rates* and *interventions*. Growth rates set the rate in which material purchases and associated impacts are expected to increase across the company or per business unit.

- working with farmers to reduce environmental impact and increase yield
- changing product recipes or fiber types and content.
- sourcing the same materials from producers with lower environmental footprints.

Users can compare scenarios to historical data, to each other, and to company targets. This enables users to evaluate the tradeoffs between different pathways and identify the actions needed to meet their environmental goals.

TABLE 1. BASELINE INDICATORS (V0.1)

LandGriffon's baseline indicators are focused on the impacts of agricultural production. The LandGriffon software and framework are designed to readily integrate additional indicators.

Indicator	Description	Data sources
Water use	The water resources consumed to produce the material. Water consumption impact calculated using product blue water footprint estimates from the period 1996-2005.	Mekonnen, M.M. & Hoekstra, A.Y. (2011) The green, blue and grey water footprint of crops and derived crop products, Hydrology and Earth System Sciences, 15(5): 1577-1600. Mekonnen, M.M. & Hoekstra, A.Y. (2012) A global assessment of the water footprint of farm animal products, Ecosystems, 15(3): 401–415.
Unsustainable water use	The water consumption in regions with a baseline water stress (BWS) ratio of more than 0.4, as identified by Aqueduct. BWS measures the ratio of total water withdrawals to available renewable surface and groundwater supplies.	Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators." Technical Note. Washington, DC: World Resources Institute. **Available online at:** https://www.wri.org/publication/aqueduct-30
Land use	The total land area required to produce the material. Land impact is calculated using material production and yield data from the global 2010 MAPSPAM and 2010 Gridded Livestock of the World v3 (GLWv3) datasets.	International Food Policy Research Institute, 2019, "Global Spatially-Disaggregated Crop Production Statistics Data for 2010 Version 2.0", https://doi.org/10.7910/DVN/PRFF8V, Harvard Dataverse, V4. Yu, Q., You, L., Wood-Sichra, U., Ru, Y., et. al. 2020. A cultivated planet in 2010: 2. the global gridded agricultural production maps, Earth Syst. Sci. Data Discuss. https://doi.org/10.5194/essd-2020-11 Gilbert, M., Nicolas, G., Cinardi, G., Van Boeckel, T.P., et. al. 2018. Global distribution data for cattle, buffaloes, horses, sheep, goats, pigs, chickens and ducks in 2010. Scientific data, 5(1), pp.1-11. https://doi.org/10.1038/sdata.2018.227

Greenhouse gas emissions	The amount of greenhouse gas (GHG) emissions arising from the production of the material. GHG impacts are calculated using impact factors from published assessments of materials' environmental impacts throughout their entire lifecycle.	Poore, J. and Nemecek, T., 2018. Reducing food's environmental impacts through producers and consumers. Science, 360(6392), pp.987-992. https://doi.org/10.1126/science.aaq0216
Deforestation risk	Forest loss occurring near material production areas. Deforestation is either calculated using Satelligence models trained to identify transitions from forest to non-forest states in satellite imagery, or using global tree cover loss data from Global Forest Watch.	Satelligence, 2022. Forest Change Bulletins. https://satelligence.com/technology Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, et al. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (6160): 850–53. https://doi.org/10.1126/science.1244693.
Climate risk from land use change	The GHG emissions associated with forest loss near agricultural production areas. The general equation for landscape-level impacts is adjusted for the mean annual gross emissions of GHGs associated with forest change from 2001 to 2019.	Harris, N.L., Gibbs, D.A., Baccini, A. et al. Global maps of twenty-first century forest carbon fluxes. Nat. Clim. Chang. 11, 234–240 (2021). https://doi.org/10.1038/s41558-020-00976-6
Biodiversity risk from land use change	The potential impact on biodiversity associated with forest loss near agricultural production areas. To align with previous analysis and with guidance from the Science-Based Targets for Nature, the indicator is calculated at two different levels: **Species:** Rarity-weighted richness serves as a measure that can be used to modify indicators. It combines species richness with the endemism of the species occurring in a given grid cell to reflect the importance of the habitat being lost for the species occurring in that location. **Ecosystem:** The change in ecosystem quality and structure associated with the sourcing of a material. This indicator expresses the average degree of intactness due to factors and indices such as habitat loss or the change in ecosystem structure as a result of deforestation.	Integrated Biodiversity Assessment Tool. https://www.ibat-alliance.org/the-data?locale=en Rarity-weighted richness: a simple and reliable alternative to integer programming and heuristic algorithms for minimum set and maximum coverage problems in conservation planning, PLoS ONE, 10 (2015), pp. 1-7, https://10.1371/journal.pone.0119905 Beyer, H.L., Venter, O., Grantham, H.S. and Watson, J.E., 2020. Substantial losses in ecoregion intactness highlight urgency of globally coordinated action. Conservation Letters, 13(2), p.e12692. https://doi.org/10.1111/conl.12692

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