

Supporting Information

Decolonizing Green Chemistry Research Through Matharu Plots

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Producing a Matharu Plot; A Step-by-step Guide

Gathering Geographic Data

We recommend integrating the collection of geographic data into the initial literature review process, ideally alongside the use of standard reference management software. This can be effectively managed by maintaining a structured table in a spreadsheet or word-processing application (e.g., Microsoft Excel or Google Sheets). Suggested data fields include the location of the publisher's headquarters, the institutional affiliation of the authors, and the authors' country of origin.

It should be noted that determining an author's country of origin presents specific challenges; this information is often not publicly disclosed, and making assumptions without the researcher's consent may lead to inaccuracies or ethical concerns. Therefore, researchers should prioritise verifiable data, such as institutional affiliation.

For journal articles and book chapters, institutional data is typically located in the "Author Information" or "Affiliations" section. If this is unavailable, a targeted web search of the author's professional profile or institutional directory usually suffices. Similarly, publisher headquarters can be identified through corporate websites. For any other document or webpage, geographic details can often be found on the hosting organisation's "About" page. Once compiled, this dataset facilitates the generation of visual analytics (e.g., heat maps or bar charts) to assess the geographic distribution of the cited work.

Ref. No.	Reference	Title	Reference Type	Publisher Country*	Publisher Continent	Author(s)'s Institution Country	Author(s)'s Institution Continent	*to the author's best knowledge
38	https://www.publish.csiro.au/CI	Efficient Synthesis of an Indinavir	Journal publication	Aust. J. Chem. - Australia	Oceania	University - Australia	Europe	
39	https://pubs.acs.org/doi/abs/10.1021/acs.accounts.2c01110	The Design of a Potent and Orally Available	Journal publication	J. Med. Chem. - USA	North America	University - USA	North America	
40	https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.201900001	Sustainable Synthesis and Polycyclization	Journal publication	ChemSusChem - Germany	Europe	Authors - France and USA	Europe and North America	
41	https://www.sciencedirect.com/science/article/pii/S0959638918300001	Cycloaddition "4 + 2" reactions catalyzed by	Journal publication	Elsevier BV - UK	Europe	University - USA	North America	
42	https://pubs.acs.org/doi/10.1021/acs.accounts.2c01110	A Convenient Procedure for the Friedel-Crafts	Book Chapter	ACS - USA	North America	University - USA	North America	
43	https://pubs.acs.org/doi/10.1021/acs.accounts.2c01110	Synthesis of Functionally and Stereoselectively	Journal publication	ACS - USA	North America	University - Australia	Oceania	
44	https://pubs.acs.org/doi/10.1021/acs.accounts.2c01110	M. Delporte, 2017 Masters Intern Optimization of the Diels-Alder	MSc Thesis	UK	Europe	Author - France	Europe	
45	https://pubs.acs.org/doi/10.1021/acs.accounts.2c01110	Transfer Hydrogenation of Biomass-Derived	Journal publication	Industrial & Engineering Chemistry	North America	University - China	Asia	
46	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC64277/	Oxa-Michael-initiated cascade reaction	Journal publication	Beilstein J. Org. Chem. - German	Europe	University - Australia	Oceania	
47	https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.201900001	Bio-Based Chiral Amines via Asymmetric	Journal publication	European Journal of Organic Chemistry	Europe	Universities - New Zealand, Aust	Oceania and Asia	
48	https://www.sciencedirect.com/science/article/pii/S0959638918300001	Michael-addition reactions of Imines	Journal publication	Elsevier BV - UK	Europe	University - USA	North America	
49	https://www.acs.org/greenchem	Endangered Elements	Online article	ACS - USA	North America	-	-	
50	https://doi.org/10.1039/C9CY00000A	Advances in understanding the hydrogenation	Journal publication	Elsevier - UK	Europe	University - China	Asia	
51	https://pubs.rsc.org/en/content/articlehtml/2019/fo/c9fo00001a	Hydrogenation of levoglucosan	Journal publication	ChemSusChem - Germany	Europe	University - USA	North America	
52	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC64277/	High stereoselectivity on low temperature	Journal publication	Switzerland	Europe	Brazil	South America	
53	https://www.sciencedirect.com/science/article/pii/S0959638918300001	The split carbonyl band in the infrared	Journal publication	Elsevier - UK	Europe	University - USA	North America	
54	https://www.google.co.uk/books	Clayden Chapter 22	Book Chapter	Published UK	Europe	-	-	
55	https://www.weforum.org/agenda/2019/01/visualizing-the-abundance-of-elements/	Visualizing the abundance of elements	Online article	Switzerland	Europe	-	-	
56	https://pubmed.ncbi.nlm.nih.gov/3401110/	Aluminum environmental pollution	Journal publication	Springer - New York	North America	University - Qatar	Asia	
57	https://publications.lupac.org/doi/10.1002/lupac.201900001	Green Lewis acid catalysis in organic synthesis	Journal publication	DeGruyter USA	North America	University - Tokyo	Asia	
58	https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.201900001	Green Lewis Acid Catalysis in Organic Synthesis	Journal publication	Online	-	University - Iran	Asia	
59	https://www.sciencedirect.com/science/article/pii/S0959638918300001	A Simple and Effective Method for the Synthesis	Journal publication	Netherlands	Europe	University - UK	Europe	
60	https://www.sciencedirect.com/science/article/pii/S0959638918300001	The Complexity of Simple Measurability	Journal publication	USA	North America	University - Canada	North America	
61	https://emis.ceriac.at/abstract/201900001	Linear Energy Solvation Relationship	Journal publication	USA	North America	Universities - Morocco, UK, USA	Africa, Europe, North America	
62	https://pubs.rsc.org/en/content/articlehtml/2019/fo/c9fo00001a	The properties of organic liquids	Journal publication	UK	Europe	University - UK	Europe	
63	https://www.sciencedirect.com/science/article/pii/S0959638918300001	A comparison of the solvation parameters	Journal publication	UK	Europe	University - UK	Europe	
64	https://pubs.acs.org/doi/10.1021/acs.accounts.2c01110	Probing the Impact of Solvent on the	Journal publication	UK	Europe	University - Canada	Europe	
65	https://pubs.rsc.org/en/content/articlehtml/2019/fo/c9fo00001a	CHEM21 selection guide of class	Journal publication	UK	Europe	Authors - France, UK	Europe	
66	https://www.legislation.gov.uk/ukdsi/2019/01/31/4008101010000001	The REACH Enforcement (Amendment)	Online document	UK	Europe	-	-	
67	https://www.mdpi.com/2673-4010	Greenness Assessment and Synthesis	Journal publication	SusChem - Switzerland	Europe	University - UK	Europe	

Figure S1: Example reference table with geographic data.

Generating the Matharu Plot

The Matharu Plot can be generated using standard spreadsheet software (e.g., Microsoft Excel, Google Sheets) or specialised data analysis packages (e.g., OriginLab). We suggest updating the plot concurrently with the literature review process. This real-time visualisation allows researchers to monitor the geographic distribution of their citations dynamically and enables immediate reflection on potential regional biases or overrepresentation.

To prepare the data for visualization, the frequency of citations per country must be quantified. While this can be performed manually, a functional approach in Microsoft Excel is more efficient:

1. Extract the "Institution Country" data into a new worksheet. Use the "Remove Duplicates" tool to create a definitive list of unique countries represented in the bibliography.
2. To determine the citation count per country, apply the COUNTIF function. For a range containing the full list of countries (G) and a specific country criterion (c), the formula is $Count = COUNTIF(G,c)$ (N.b. Use absolute cell references for G , e.g., $\$B\$2:\$B\76 , to fix the range when applying the formula across the dataset.)
3. Sort the resulting tally table alphabetically or by frequency to ensure a structured dataset.

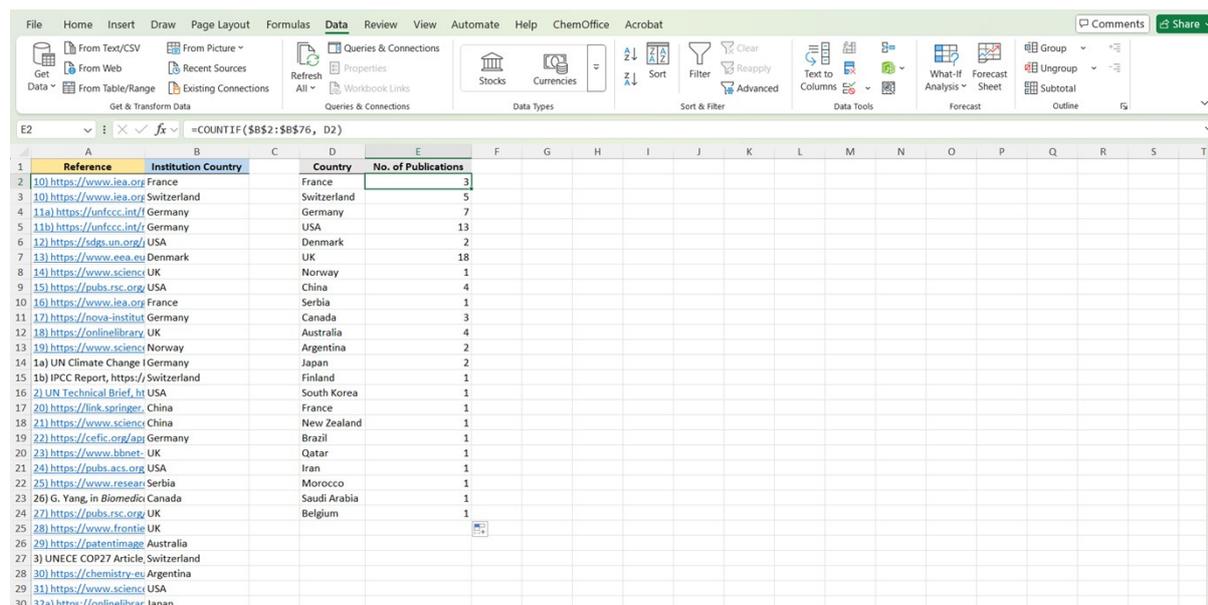


Figure S2: Example tally table for institution country.

Once the tally table is complete, select the data and insert a "Filled Map" (or "Map Chart"). This generates a global heat map where colour intensity corresponds to citation frequency, effectively highlighting the geographic footprint of the cited institutions. The resulting charts can be exported to presentation software (e.g., Microsoft PowerPoint) for final aesthetic refinement and integration into infographics or manuscripts.

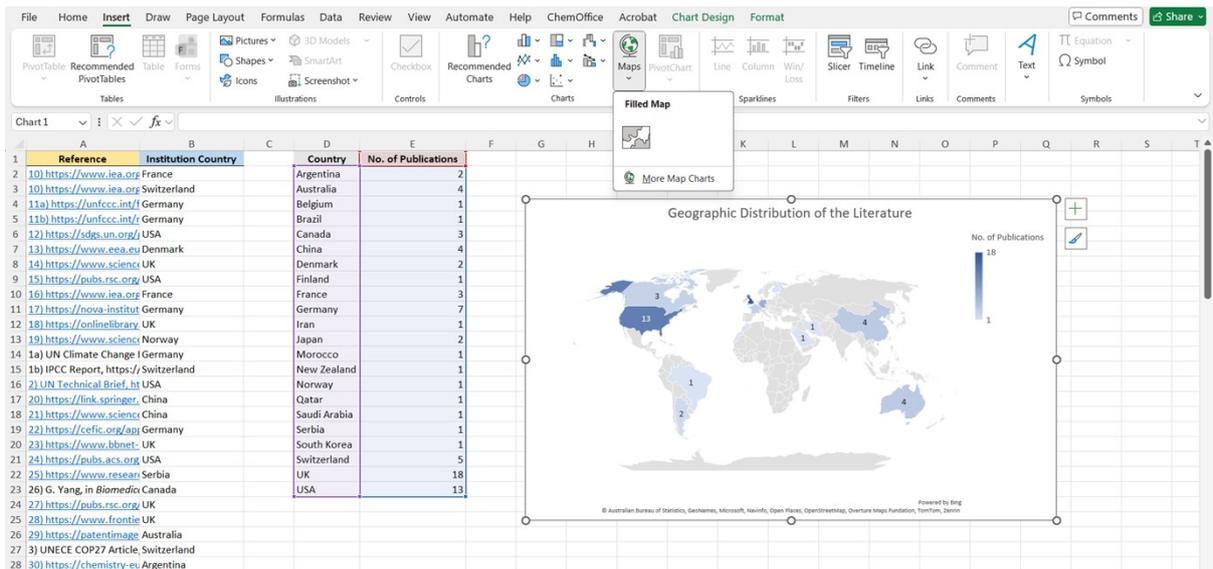


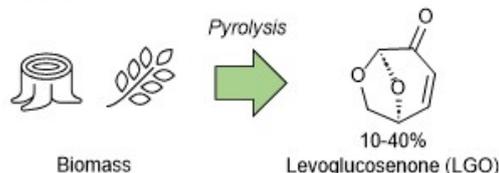
Figure S3: Example tally table for institution country.

Producing the Infographic

Following the generation of the individual charts, a comprehensive infographic can be produced using standard presentation software (e.g., Microsoft PowerPoint or Google Slides). The objective is to construct a ‘visual essay’ of the bibliography’s geographic distribution and challenges the researcher’s ability to balance the aesthetic clarity with high informational density.

The benefit of the Matharu Plot lies not simply in the visualisation itself, but in the subsequent critical analysis. Researchers are encouraged to evaluate the drivers behind the observed data distribution and to consider how the specific scope of their research, regional funding patterns, and historical academic structures may influence geographic representation in their citations.

The literature cited in the research project focused predominantly on the bioderived platform molecule levoglucosenone (LGO) and its Lewis-acid-catalysed reaction with 2-methylfuran.



The high number of publications from Australia/UK is assumed to be because Circa, the manufacturers of levoglucosenone and Cyrene™, have operation locations in these countries. Furthermore, there are patents that reduce the availability of performing research on LGO and Cyrene.

Geographic Distribution of the Literature



While systemic inequities often limit publication volume from the Global South, these regions remain important for innovation. In this work, 32% of total references originate from 7 Global South nations, demonstrating that these regions provide essential, high-value intellectual resources for advancing biomass valorisation. It is therefore essential not to overlook research conducted or published in the Global South due to prejudice.

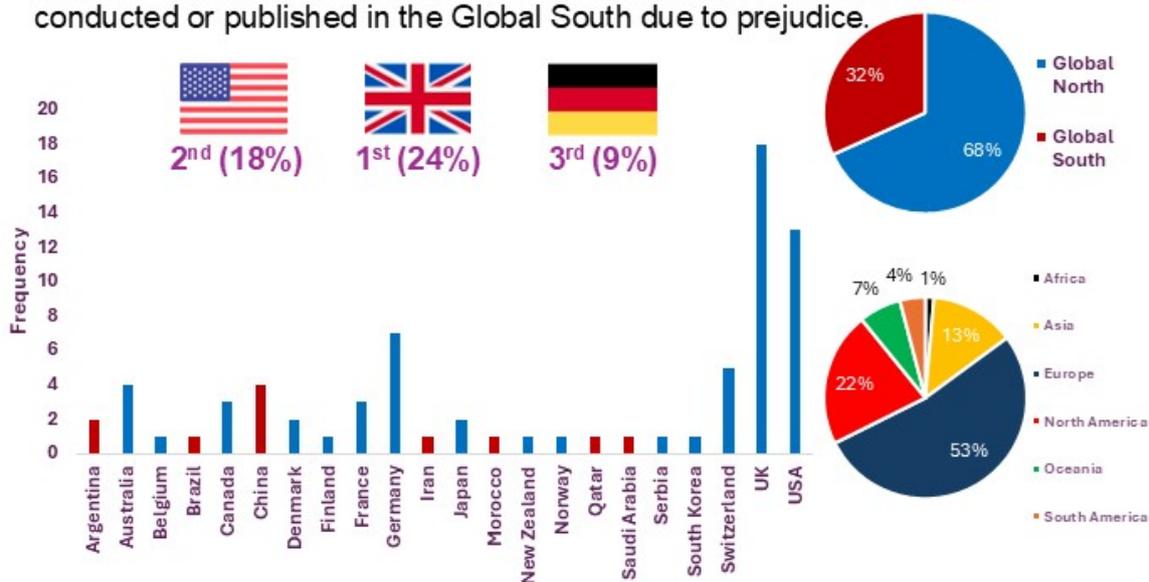


Figure S4: Example infographic.