**Introduction**

Humans are using nature’s resources at a rapid and likely unsustainable rate. The Ecological Footprint measures the consumption of renewable biological resources, broken up into types of resources. Global Footprint Network calculates the Ecological Footprint of nations but the primary data doesn’t reveal what elements are driving the ecological deficits. Global Footprint Network has a supplementary Multi-Region Input Output model that provides the national Ecological Footprint results in categories that people can relate to, especially in terms of final consumption.

The differences in results between the two models limit the ability of the organization to make full public use of both models because the details underlying the divergence are highly technical. Furthermore, troubleshooting the most unlikely outlying results is difficult because of the huge amount of data and the complexities of each model. We will provide a set of deliverables that address these two issues.

**Client Description and Their Ask of Us**

Our client is the Global Footprint Network (GFN), a local nonprofit that has established a sophisticated global accounting system for the Earth’s carrying capacity and humanity’s consumption demands on that capacity. In their on-going efforts to make their accounting system more understandable to the public and policymakers GFN has developed a dataset, the Consumption Land Use Matrix or “CLUM,” that provides a more readily understandable set of consumption categories than their original dataset (the National Footprint Accounts, or “NFA”). For example, the public-facing data from the NFA report out the total equivalent of “Grazing Land” or “Carbon” consumed in a given country in a given year.[[1]](#footnote-1) The CLUM provides an accounting system that uses the more-easily understood consumption categories of “food, “housing”, “goods”, “services”, and “transportation”.

GFN serves the public, and particular clients - including various governments - that seek to better understand their impact on the environment, and ways to mitigate that impact and the consequent risks. Providing Ecological Footprint results in terms that directly address these concerns and client interests is core to their research, dedicated to ”enabl[ing] a sustainable future where all people have the opportunity to thrive within the means of one planet.”

We will address two problems that GFN currently faces with the CLUM data. The first is that the dataset conflicts with the primary NFA dataset. While GFN is aware that the data conflict, they have not been able to understand where the conflicts are large, or where there are patterns. Related to this issue is their inability to fully utilize the CLUM results in their public-facing work.

The second problem is that there is no method for measuring the efficiency or intensity using the CLUM categories. A country could have a very low level of consumption of housing, for example, but it is currently unknown whether this is the result of extremely poor-quality housing (as might be expected in Sierra Leone) or because the country provides quality housing through extremely efficient, low-intensity means (as might be expected in Singapore). GFN uses the UN Human development Index as a means of normalizing a country gross consumption from the NFA results, but does not have an equivalent index for its 5 CLUM categories of consumption.

**Data & Methods**

GFN has provided our team with the latest version of the CLUM data as a large Excel file. We will initially explore these data using a wide variety of visualizations including scatterplots and proportional symbol maps. We will create visualizations and other data interpretations to create analysis tools for GFN to systematically examine the CLUM results, and to create public-facing visualizations with a level of resolution that won’t cause unnecessarily complicated explanations of the methodology. We will add value and secondary analysis by researching indices to normalize the CLUM data using traditional scholarly research techniques including reviews of the literature and interviews with experts in international standardized data on the variables in question.

**Iterative Collaborative Process**

We begun with meetings with our partner, and meetings within our group to establish an approach and direction that will serve our combined needs. We are intentionally beginning with visualizations of the data itself as an entry way for our group to become familiar with the data, its structure, and an overview of the insights it provides. This approach also provides two useful deliverables as a baseline for our work with GFN: visualizations for potential public presentation; comprehendible systematic structuring of the CLUM results for GFN internal troubleshooting use. We have established the likely next step of secondary analysis, while remaining open to pivots, as the project, our relationship with the client, and our understandings of the data and its potential develop.

**Deliverables**

1. A series of visualizations with explanatory text describing various options for presenting the CLUM data, and noting cases where the CLUM results appear to diverge from the NFA results.
2. A proposed, sourced, set of normalization indices for the 5 CLUM categories
3. One or more visualizations of the normalized CLUM data.

**Timeline for project with deliverables, time/team member**

All team members will work 13 hours per week on this project.

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|  | **Eli** | **Nat** | **Scott** |
| **Jan** | * Met with client, received dataset, discussed potential projects | | |
| **Early Feb** | * Initial visualizations of the CLUM data (R-Shiny) | | |
| **Feb** | * Goods Index Research * Services Index Research | * Housing Index Research * Transportation Index Research | * Initial visualizations * Food Index Research |
| **Mar** | * Further visualizations | * Further visualizations | * Government Index Research * Gross Fixed Capital Formation Research |
| **Apr** | * Final report writing, final visualization tweaking | | |
| **May** | * Final meetings with client and presentation to class | | |

All deliverables will be presented to the client in late April.

**Fallback position**

There may be no comprehensive measure of efficiency or intensity across all 140 countries and regions for the CLUM categories. In this case our objective is to document our findings fully and propose a next-best solution.

1. The units used for measuring the quantity of “land consumed” are global hectares (GHA), which is (from our understanding) a hectare equivalent to the average productive hectare in the world. [↑](#footnote-ref-1)