

# SVALBARD GLOBAL SEED VAULT: Banking on Agrobiodiversity & Food Security

## Background

About halfway between the North Pole and continental Northern Europe, Svalbard, an unincorporated Norwegian archipelago, houses the most extensive agricultural seed bank on the planet. The Svalbard Global Seed Vault (SGSV) stores agricultural seeds from around the world, aiming to preserve and record the genetic diversity of agricultural species, or agrobiodiversity.

Maintaining agrobiodiversity is key to developing agricultural resilience, because it enables food supply adaptation in varying environmental conditions and production demands. Globally, crop biodiversity origins, a given crop's region of greatest natural biodiversity, and food supplies have become increasingly inter-regionally intertwined; geographic regions rely upon crops of non-native biodiversity origins (Khoury et al. 2016, Figures 1-2). This study analyzes the Svalbard Global Seed Vault as a critical agrobiodiversity resource, mapping its potential underrepresentation of global agrobiodiversity and food security needs.

## Research Questions

- Are there global geographic trends in SGSV's agrobiodiversity resource preservation and representation?
- What global patterns exist between SGSV's preservation of agrobiodiversity, food security, and actual agrobiodiversity?
- Which regions are the most valuable agrobiodiversity origins to global food supplies, and... have low food security? Have poor agrobiodiversity representation in SGSV?

## Methods & Analysis

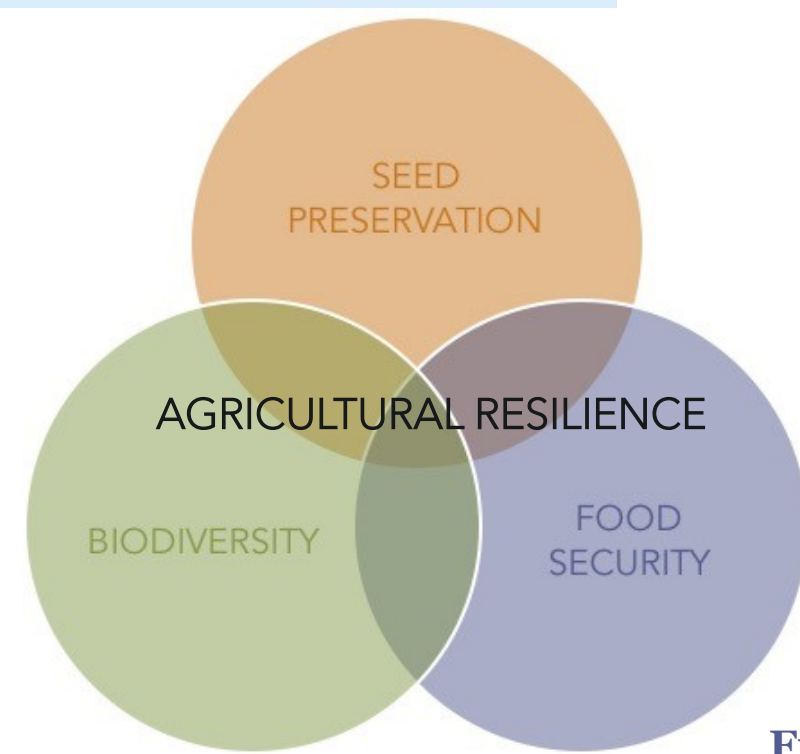
Two separate analyses were performed to (a) map the global flows of seed biodiversity to Svalbard and (b) index SGSV's archives by biodiversity origin in the contexts of global food security and agrobiodiversity value to food supplies.

### (a) Agrobiodiversity to SGSV Flow:

Unique taxa were used to indicate seed biodiversity in SGSV. Taxa and depositing country information of SGSV-held seeds were joined with 22 agrobiodiversity origin regions from "Origins of Food Crops Connect Countries Worldwide" and country polygons. Regions were converted to centroids from which flow lines connected to Svalbard using the XY Line tool. Flow lines were weighted by the respective origin region's percent of all unique taxa held by SGSV, with region centroids weighted by percentage of total seeds held by SGSV.

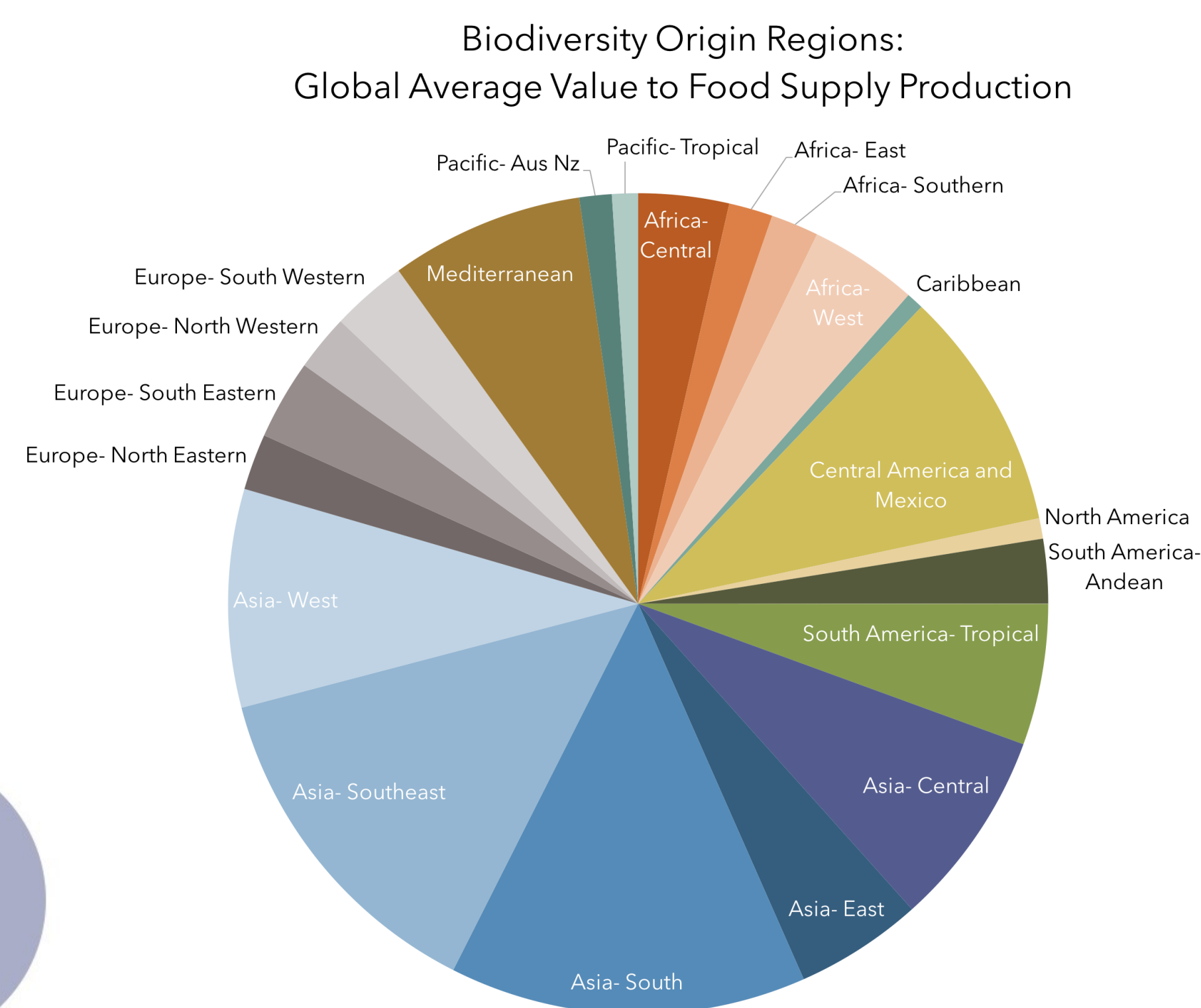
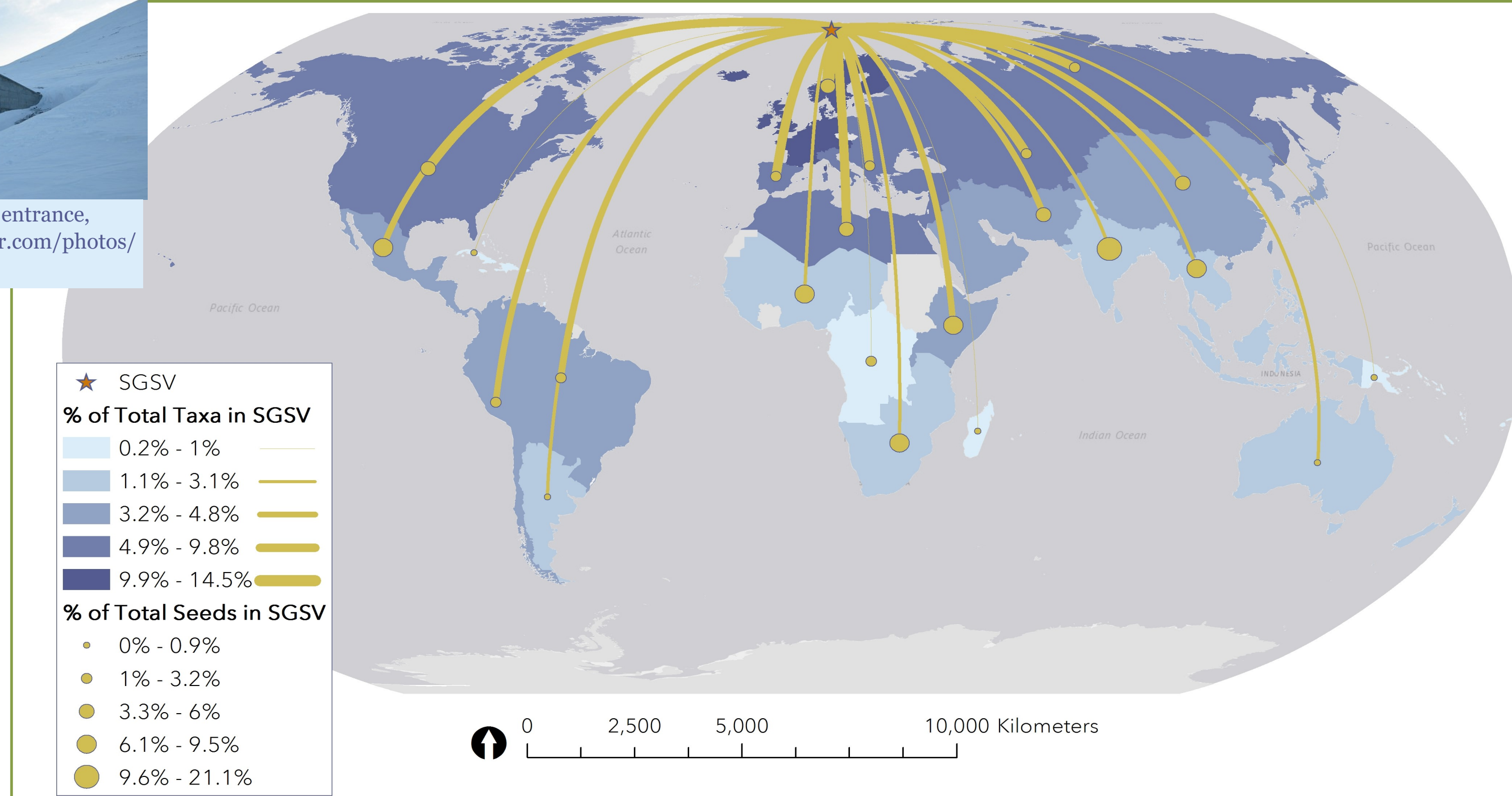
### (b) Agrobiodiversity Resilience Indexes:

Three dimensions were incorporated biodiversity, food security, and seed preservation. Data for each of these dimensions were joined to country and agrobiodiversity region centroids, from which five density rasters were calculated using the Kernel Density tool. Density rasters were added and reclassified into index values for each dimension. High values correspond to low agrobiodiversity value to food supplies, surplus per capita food supply, and greater biodiversity representation in SGSV. Low values indicate high agrobiodiversity value to food supply, per capita food deficit, and low biodiversity representation in SGSV. The resulting three dimension indexes were combined into one Agricultural Resilience Index (Combined Index).

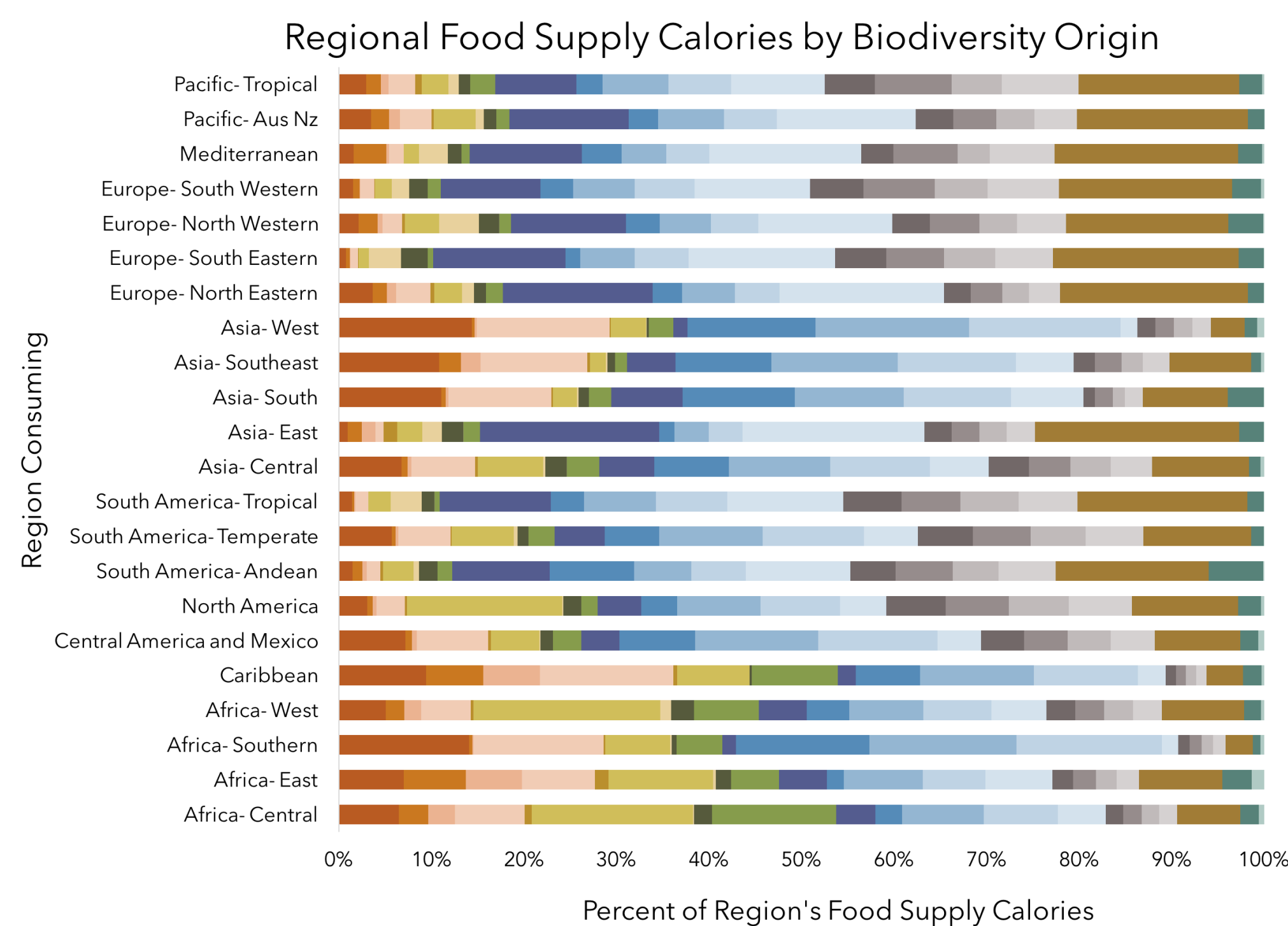


Svalbard Global Seed Vault entrance, Norway. From <https://flickr.com/photos/croptrust/>

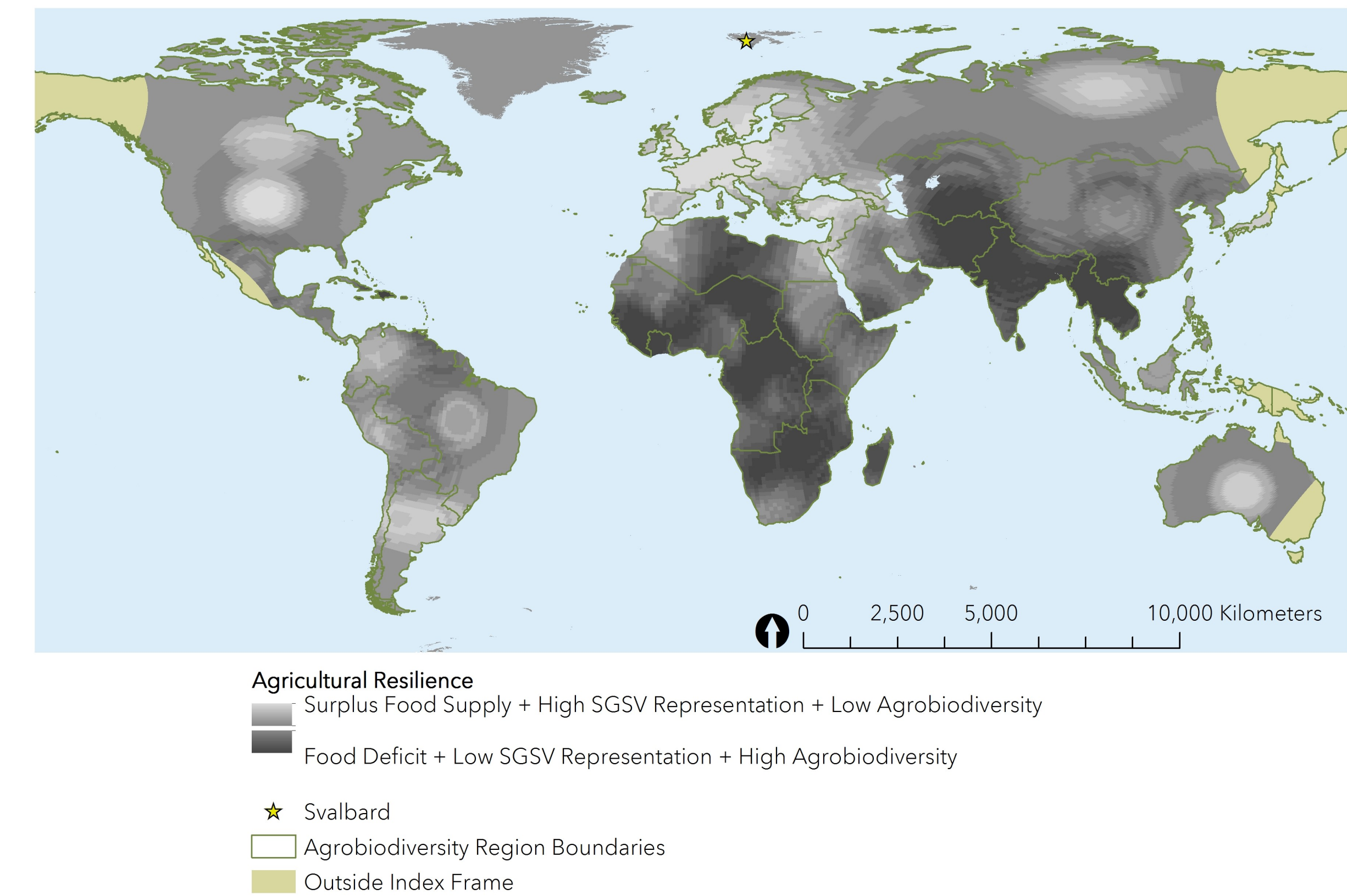
## Agrobiodiversity Flow to SGSV



**Figure 1 (above):** Each region's average agrobiodiversity value to food supply production. Portions depend on degree of inter-regional food supply reliance on biodiversity. Inter-regional dependence is shown in **Figure 2 (below)**: bar colors correspond to color assignments in Figure 1, showing the proportion of food supply calories each agrobiodiversity region contributes. The Figure 2 breakdowns averaged and averages in Figure 1 were used to construct the Biodiversity Index. Data sourced from Khoury et al. 2016.



## Combined Index



## Findings & Future Research

### (a) Agrobiodiversity to SGSV Flow:

Percent of seed taxa represented in SGSV varies significantly by agrobiodiversity region, indicating differences in regional preservation. Northwestern Europe has the greatest taxa diversity. The Southern Hemisphere overall has less represented biodiversity.

### (b) Agrobiodiversity Resilience Indexes:

Combined index scores ranged from 14-34 out of a possible 5-36. This indicates that high-scoring regions have a stronger correlation of high food security, lower agrobiodiversity value, and high SGSV representation than the lower end scores do to low food security, higher agrobiodiversity value, and low SGSV representation. Clustering of either scoring ends in Western Europe, Africa, and Southern Asia indicate SGSV's contents align with other global food system patterns. Noting low-scoring regions (Central Africa, Southern Asia) is critical, as investment in these regions' agrobiodiversity resilience is more crucial to local and global food supply security.

Given these findings, especially the clustering of high index values in regions near SGSV, future research may raise questions of the efficacy of SGSV as an aid to global agrobiodiversity resources.

## Limitations

This research does not conduct comprehensive analysis of food security and biodiversity; only several factors were included as proxies for these dimensions, while there are multitudes of environmental, economic, and social factors that influence a given region or country's global agrobiodiversity value and level of food security. Aggregation of data into country and regional centroid units assumes data location is central, omitting some geographic distributions and decreasing accuracy due to zonation.

### Madeline Lee | GIS 101 – Introduction to GIS | May 8, 2018

Data & Sources: Svalbard Global Seed Vault Database 2018, FAOSTAT 2014-2016 Food Security Dataset, ESRI (Tufts M Drive). Title Photo from the International Rice Research Institute. Crop Trust. (n.d.). *Svalbard Global Seed Vault*. Retrieved April 11, 2018, from Crop Trust: <https://www.croptrust.org/our-work/svalbard-global-seed-vault/>. Khoury, C. K., et al. (2016). Data From: Origins of Food Crops Connect Countries Worldwide. *Proceedings of the Royal Society B: Biological Sciences*, 283(1832). <https://doi.org/10.5061/dryad.s08t2>. Spatial Reference Information: Projections: Flow Map- Robinson World | Coordinate System: GCS | Datum: WGS 1984

## Dimension Indexes

