2023 Great Lakes Data & Analytics Summit



The language and dialects of DATA VISUALIZATION Alberto Cairo





'The Art of Insight' is, in part, about how the way I **teach** and **think** about data visualization has evolved.

2019

November of 2023





What I still teach: The value of visualization as a language



Generative art by Nadieh Bremer



The most-viewed story ever published by The Washington Post online



https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

Alberto Cairo To... 👗

set the record for converting readers to subscribers.

https://www.washingtonpost.com/pr/2020/06/26/washington-post-expand-graphics-design-teams-with-14-new-positions/

The Post's visual journalism, which involves staff throughout the newsroom, has attracted large audiences and contributed to record subscriber growth. Six of the seven most visited stories in The Washington Post's history have been graphics, including the coronavirus simulator that became the most visited article in The Post's history, with more than three times as many visits as the second. It also includes this year's Democratic candidate quiz, which

The human brain evolved to detect **patterns**...



The human brain evolved to detect **patterns**...





...and the exceptions and departures from those patterns.



The relationship between patterns and their exceptions is a key principle of data exploration: uncover patterns and trends, but don't forget the exceptions to those patterns and trends. John W. Tukey



"The greatest value of a picture is when it forces us to notice what we never expected to see."

John W. Tukey

Length or height



Encoding data

Data visualization consists of mapping data onto attributes of objects commonly abstract shapes.

22%, 25%, 34%, 29%, 32%

And the great news is that this stuff isn't magic.

The same way that anybody can learn to write well, anybody can learn to design pretty decent data visualizations and data stories.

FLORIDA: WHY ARE SO MANY SENIORS STRUGGLING?

sset Limited, Income Constrained, Employed (ALICE) is a segment of the U.S. population who do not meet federal poverty levels but are struggling to make ends meet. In Florida, households 65 years and older saw the greatest increases below the ALICE threshold across all ethnic and racial groups; however, total households for those 25 years and under decreased. Florida also leads the nation with the greatest number of seniors

with many dependent on Social Security as their primary source of income. Housing is at an all-time high negatively affecting the overall health of many low-income Floridians. With formal care costs out of reach for most households, informal caregivers will continue to feel the financial burden of long term care. As more Floridians struggle to get by, will Florida have policies in place to address the monumental impacts of an aging population?

NEARLY 50% OF FLORIDIANS FIGHT TO SURVIVE



SOURCE: UNITED WAY 2016 ALICE REPORT

SENIORS, 45-64 YEAR OLDS INCREASINGLY STRUGGLE

PERCENT CHANGE OF HOUSEHOLDS BY AGE BELOW THE ALICE THRESHOLD FROM 2010 TO 2016



SOURCE: UNITED WAY 2016 ALICE REPORT

MEDIAN INCOME BARELY COVERS THE BASICS

THE STRUGGLE TO AFFORD THE ESSENTIALS LEAVES LITTLE ROOM FOR UNEXPECTED COSTS



SOURCE: AMERICAN COMMUNITY SURVEY 2017



FLORIDA: THE NATION'S OLDEST STATE

MAINE, WEST VIRGINIA AND VERMONT FOLLOW WITH THE HIGHEST PERCENTAGE OF SENIORS (65+)





49%

Glades

Collie

20%

46%

PERCENT OF SENIORS **BELOW THE ALICE** THRESHOLD

Lafayette	49%
Glades	46%
LOWEST PI	ERCENTAGE
OF ALICE H	OUSEHOLDS 65
OF ALICE H	OUSEHOLDS 65

Collier 20% Leon 20%

20% OR LESS 0% OR MORE

SOURCE: UNITED WAY 2016 ALICE REPORT

SOCIAL SECURITY: A KEY INCOME SOURCE FOR SENIORS

RELIANCE ON SOCIAL SECURITY AS PERCENT OF TOTAL INCOME FOR PEOPLE 65+ YEARS



LONG TERM CARE STRAIN ON THE HORIZON

Costs for longterm care ("custodial care") support in Florida will continue to increase at alarming rates forcing vulnerable populations to seek alternatives. Medicare can cover a fraction of costs and the bulk of the financial burden falls on individuals and families. Medicaid is only available for Americans with the lowest incomes with caveats. When it comes to long term care, ALICE households are forced further to the margins.

FORMAL CARE COSTS WILL CONTINUE **TO OUTPACE U.S. INFLATION RATES**

FLORIDA'S ANNUAL PROJECTED MEDIAN CARE COSTS IN THOUSANDS



NOTE: FUTURE YEARS CALCULATED ASSUMING AN ANNUAL 3% GROWTH RATE. HOME HEALTH CARE BASED ON 44 HOURS PER WEEK BY 52 WEEKS, ASSISTED LIVING BASED ON 12 MONTHS OF CARE, PRIVATE, ONE BEDROOM, ADULT DAY CARE BASED ON 5 DAYS PER WEEK FOR 52 WEEKS, NURSING HOME CARE BASED ON 365 DAYS OF CARE, SEMI-PRIVATE ROOM, SOURCE: GENWORTH COST OF CARE SURVE

NUMBER OF FAMILY CAREGIVERS PROJECTED TO PLUNGE

POTENTIAL CAREGIVERS AGED 45-64 YEARS FOR EACH PERSON AGED 80 AND OLDER



WHAT COULD FLORIDA DO TO HELP SENIORS?

ACCORDING TO AARP, COMPREHENSIVE PEOPLE-FOCUSED POLICIES COULD MAKE A BIG DIFFERENCE



EXPAND MEDICAID: Non-elderly adults without dependents could be covered and the . health coverage gap for nearly 400,000 Floridians would be reduced.



\$237

Nursing Home Care

Home Health Aide

\$102

Assisted Living

Adult Day Care

\$43

2048

SOURCE: AARP PUBLIC POLICY INSTITUTE

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formal care costs out of reach for most households, informal caregivers will continue to

NEARLY SK To: Cairo, Alberto SENIORS I have really enjoyed this course, wanted to pull my hair out many times, but it has completely changed the way I think about charts and design.

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Sometimes it does require a bit of pain, though...



Florida 20.1%

Wed 4/26/2023 5:08 PM

2016	20% OR LESS	50% 01	R MORE			199	0 2010	2030	
	SOCIAL SE RELIANCE ON SC	ECURITY: A K	EY INCOME SOUP	RCE FOR SENIORS		WHAT C	COULD FLORIDA DO TO AARP, COMPREHENSIVE PEC	TO HELP SENIO	DRS?
ncome ds)	BOTH SEXES	31.4	4.6 21.6	42.5	Percentage of income	IMPROVE OVERALL LONG TERM SERVICES AND SUPPOR increase, including the promise for seniors and adults			SS): Quality 1 disabilitie
	FEMALE	37	4.8 22.2	36.1	from Social Security	Costl	EXPAND HOME AND COMMUNITY-BASED SERVICE costly nursing homes and family caregivers w	ASED SERVICES (HCBS): M caregivers would be ab	lore Florid le to recei
	MALE	24.6 4.3	20,8		50-89.9% < 50%	expa	AND MEDICAID: Non-elderly a lth coverage gap for nearly 4	dults without depender 00,000 Floridians woul	nts could b d be reduc



Day Care

JNGE

ited States

orida

How and why my teaching and thinking have evolved

Generative art by Nadieh Bremer



The first reason is that I get variations of this question regularly:

"What are the **rules** of data visualization design"?

"Rules"?

Some of these books are very intimidating to beginners because of how stern and **prescriptive** they are.



2nd Edition Data Visualisation A Handbook for Data Driven Design Andy Kirk (



Even what the most common "rules" of visualization have shaky foundations and can be questioned

"Bar graphs must always start at 0" 50%-50> 45% 45% 40% Non-zero baseline











From 'How Charts Lie':

The encodings in a line chart are position and angle, and these don't get distorted if we set a baseline that is closer to the first data point. These two lines look exactly the same, and neither lies; the only difference is that on the first one I emphasize the baseline —because it's 0— and on the second I don't —as the baseline is like any other gridline, and I want to make clear *that it's not 0*:





















Or do they focus mostly on the upper edges and read the Y-axis scale?













upper edges and read the Y-axis scale?

.In which case a non-0 bar graph is neither better nor worse than a non-0 line graph

This said, **I still recommend** that bar graphs start at 0. The **reason** isn't that they may be misleading otherwise, but that the encoding we use when building them is height/length. Therefore, bar height/length should be proportional to the quantities they represent (a line graph, on the other hand, uses relative position as encoding).

For more information:

https://papers.ssrn.com/sol3/ papers.cfm?abstract_id=2566968

https://eagereyes.org/papers/anempire-built-on-sand









The second reason for changing the way I teach visualization is observing its diversity: Ed Hawkins's 'Warming stripes' (read more: <u>https://chezvoila.com/blog/warmingstripes/</u>)











Ed Hawkins defined a goal:

He wanted general audiences to pay attention to the main point his chart makes. Not to understand the data in depth, or to analyze it. Just to look at it and become curious.

He also made the graphic look colorful and fun.

Hawkins designed his graphic knowing little about data visualization "rules" or "principles".





Ed Hawkins defined a goal:

He wanted general audiences to pay attention to the main point his chart makes.

He also made the graphic look colorful and fun.

Are most people more likely to look at this...?



Not to understand the data in depth, or to analyze it. Just to look at it and become curious.





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- EXPAND HOME AND COMMUNITY-BASED SERVICES (HCBS): More Floridians could avoid costly nursing homes and family caregivers would be able to receive assistance.
- EXPAND MEDICAID: Non-elderly adults without dependents could be covered and the health coverage gap for nearly 400,000 Floridians would be reduced.
 - GRAPHIC: DEB PANG DAVIS / IMM622 INTRO TO DATA VISUALIZATION

I've come to realize that these visualizations share an underlying grammar but they differ in fundamental ways. They might be examples of different visualization dialects.





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Explorative -0
Expositive —O
Explanative -0
Emotive —





Teaching visualization:

Pretty much like writing, visualization design doesn't consist of applying "rules".

Rather, it's based on making justifiable —ethically, functionally, aesthetically— choices considering goals and constraints.



A good exercise: Reverse-engineering existing visualizations "If I were the designer who created this, what choices would lead me to this solution?"

AMERICAN SOCIETY of NEWS EDITORS

How Diverse Are US Newsrooms?

The Newspaper Diversity Survey measures the percentage of women and minorities working in US newsrooms. The results from 2018's survey are in.



8: Top Newsrooms	Overall Change	My Newsroom
1.5.1		

https://googletrends.github.io/asne/

How Diverse Are US Newsrooms?



80%		Average:	50/50		
Male Staff	70% I	59% Male	split		70% Fema
00 00 0				\bigcirc 0 0	0



How Diverse Are US Newsrooms?



80% Male Staff	70%	Average: 59% Male	50/50 split		70% Fema
				∞ 0 0	0
80%		Average:	50/50		
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How Diverse Are US Newsrooms?





How Diverse Are US Newsrooms?





How Diverse Are US Newsrooms?





How Diverse Are US Newsrooms?







80%









What graphic forms should I use?



Generative art by Nadieh Bremer



I still recommend resources like these to my students:



http://www.datavizcatalogue.com/



Visual vocabulary

Designing with data

There are so many ways to visualise data - how do we know which one to pick? Use the categories across the top to decide which data relationship is most important in your story, then look at the different types of chart within the category to form some initial ideas about what might work best. This list is not meant to be exhaustive, nor a wizard, but is a useful starting point for making informative and meaningful data visualisations.

FT graphic: Alan Smith; Chris Campbell; Ian Bott; Liz Faunce Parrish; Billy Ehrenberg; Paul McCallum; Ma



The standard way to show the relationship between two continuous variables, each of which has its

adds additional detail by sizing the circles according to a third variable.







Ranking

Use where an item's position in an ordered list is more important than absolute or relative value. Don't be afraid to highlight the points of interest.

Example FT uses Wealth, deprivation, league tables, constituency election results

Standard bar charts display the ranks of values much more easily when sorted into order.

variations between values and/or seeing fine differences between data is not so

See above

Ordered bar

F

Ordered column

h.

Lollipop chart

Ordered proportional symi

Dots placed in onter on a strip are a space-efficient method of laying ou ranks across multipli categories.

Perfect for showing how ranks have changed over time or vary between categories.

Lolipops-draw more attention to the data where than standard ber/column and can also show rank and value effectively

Show values in a dataset and how often they occur. The shape for two of a distribution can be a memorals way of highlighting the lack of uniformity or equality in the data.

Distribution

Example FT uses Income distribution, population (age/sex) distribution





Vialin plat

÷ but more effective wi complex distributions (data that cannot be summarised with simple everage).



Dot strip pla Good for showing individual values in a problem when too many dots have the same value.

Dot plot A simple way of showing the change or range (min/max) of data across multiple categories.







Give emphasis to changing trends. These can be short (onra-dey) movements or extended arries traversing decades or centuries. Checking the correct time period is important to provide suitable contex for the reader.

Example FT uses Share price movements, economic time series





Line + column A good way of showing the relationship over time between an amount cotumna) and a rate dine).

Usually focused and day-to-day activity, these charts show opening/dosing and hylow points of each day



changing data as long as the data can be simplified into 2 or 3 points without missing a key part of story.



Fan chart (projections) Use to show the uncertainty is future projections - usually this grows the further forward to projection.

A good way of showing changing data for two versibles whenever there is a relatively clear pattern





Circle timeline Good for showing discrete values of varying size across multiple coregories (eg earthquakes by contintent).



Part-to-whole

Show how a single entity can be broken down into its component elements, if the reader's merest is solely in the size of the component consider a magnitude-type chart instead.

Example FT uses Fiscal budgets, company structures national election results



Propertional stacked ha



owing part-to-whol ta - but be oware it it's difficult to surately compare the s of the segments.



rt-to-whole ationships; can be ficult to read when ere are many small



ed for visualising litical results in rliaments. 11



Generally only used 8 for schematic representation.



Can be useful for showing part-to-whole relationships where some of the components are negative.



Show size comparisons. These can be relative Quart being able to see larger/bigge? or absolute Greed to see fine differences). Usually these show a counted runther (for example how a counted runther than barrest, delates or becelor or ather than a calculated rate or per cent.

Example FT uses Commodity product capitalisation tion, market



Paired column

llhi

Paired bar



olumn but allows t nuttiple series. Can

ice above.



A good way of showing the size at proportion of data at he same time - as hg as the data are too complete **Proportional symbol**



ttttt some instances - use only with whole numbers (do not sito off an arm to





An afternative to rada charts - again, the arrigement of the variables is important Usually benefits from highlighting values.







Spatial

Used only when precise locations o geographical patterns in data are more important to the reader than anything else.

Example PT uses Locator maps, population develop, natural resource locations, natural disaster mk/impact, catchment an variation in electron results

Basic choropleth (rate/ratio) The standard approach for porting date on a map - should always be rates rather than states and use a sensible base

Use for totals rather than rates - be wary that small differences in data will be hard to see.

For shawing unambiguous movement across a map

Contour may For showing areas of equal value on a map con use deviation colour schemes for showing */- values

Converting each unit of a regular and equally-sized shape - good for representing voring regions with

Scaled cartogram (value) Stretching and shinking a map so that each area is sized according to particular value.

Dot density Used to show the location of individual events/locations -make to annutate any patterns the reader should see.

Heat map

Grid-based date values mapped with an unensity colour scale. As choropteth map -but not snapped to an edminobilized unit.



https://github.com/ft-interactive/chart-doctor/blob/master/visual-vocabulary/Visual-vocabulary.pdf













Flow

Show the reader volumes or intensity of movement between two or more states or conditions. These reight be logical sequences or geographical locations.

Example FT uses Movement of funds, trade, migrants, lawouts, information, relationship graphs.

Sankey

ows changes in flows im one condition to least one other, good tracing the eventual toonle of a complex 1



Besigned to show the sequencing of data through a flow process, typically hudgets. Can include */* components.



A complex but powerful diagram which can illustrate 2 way flows (and ne winned) in a matrix.



Used for shawing the strength and inter-connectdness of relationships of varying types.





But I also try to teach them how to reason about their choices

Figure 2 - Main nationalities of arriving migrants - 2016

Greece





	Syria	47%	
	Afghanistan	24%	
	Iraq	15%	
Syria	Pakistan	5%	
	Iran	3%	
	Palestine	1%	
	Algeria	1%	
	Others	4%	

How should I annotate my visualization?



Generative art by Nadieh Bremer

Boys born in **Blackpool** can expect to live just 74 years — the second lowest in the UK, and up by just 2.7 years since 1993



"Design secrets behind the FT's best charts of the year" https://www.ft.com/content/4743ce96-e4bf-11e7-97e2-916d4fbac0da

Kensington & Chelsea +9

"I and my colleagues here at the FT, we really do think one of the most valuable things we can do as data visualization practitioners is add this expert annotation layer." John Burn-Murdoch **Financial Times** https://policyviz.com/podcast/ episode-155-john-burn-murdoch/



Am I paying enough attention to visual design?

Generative art by Nadieh Bremer



UNIVERSITY OF MIAMI Multi-scale Modeling and Assessment of Malaria Risk in Northern ABESS CENTER for ECOSYSTEM **South America** SCIENCE & POLICY

Alimi, T. O.¹; Fuller, D. O.^{1,2} and Beier, J.C.^{1,3}

¹ Abess Center for Ecosystem Science and Policy; ² Department of Geography and Regional Studies; ³ Department of Epidemiology and Public Health, University of Miami

1. Introduction

The public health problem posed by malaria has made it a top priority for control efforts and the general consensus globally, is that its elimination is crucial for continued international development. Consequently, there is ongoing research in different regions including South America (SA) to better understand the disease dynamics with the intent that findings may establish scientific framework that would support the development of new intervention strategies for malaria elimination in areas with seasonal malaria. One of such investigations is undertaken by the International Centers of Excellence in Malaria Research (ICEMR) under a National Institutes of Health (NIH) grant.

While only about 3% of the global malaria burden is borne by SA¹, undertaking malaria research in the region is currently important because an estimated 23million people are still at risk² and approximately about 80% of clinical cases are found in Northern South America (NSA)³. A key factor limiting effective control is lack of data and uneven implementation of control measures, including use of bednets, sprays, early diagnosis, and treatment. As part of the ICEMR investigation, this project seeks to model the spatial patterns of malaria risk in NSA through vector distribution and land-use changes. Furthermore, I intend to investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.

2. Significance

Spatial distribution of malaria risk is still perceived as broadly categorized by the WHO's traditional risk maps which are highly generalized, of low resolution and have broad categories with uncertain boundaries (see da Nunes-Silva et al. 2012). There is need for up- to-date high resolution risk maps which can aid malaria control efforts. Secondly, modeling distribution of principal malaria vectors and land use changes which may explain the observed distribution and risk are useful tools which would guide future management strategies. Finally, understanding the perceptions of at risk populations may help address barriers to adoption of interventions and influence policies. Overall, findings will empower NMCPs to achieve effective control and move them closer to elimination.

3. Specific Aims

- > Specific Aim 1: Model the spatial patterns of malaria risk through vector distribution and land use changes
 - Hypothesis 1.1: GIS-based Multi-Criteria Evaluation (MCE) model can accurately predict spatial extent of malaria risk areas. Objective: Generate risk maps that represent risk of malaria transmission.
 - · Hypothesis 1.2: The Maximum Entropy (Maxent) model can accurately depict actual and predict potential distribution of three Anopheles species. Objective: Model observed and potential spread of An. albimanus, An. darlingi, and An. nuneztovari.
 - · Hypothesis 1.3: Land- use changes can explain the variations in predicted malaria risk. Objective: Characterize land use land cover (LULC) and investigate changes in areas of risk.
- > Specific Aim 2: Investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.
 - Hypothesis 2.1: Knowledge of perception of malaria risk can aid design of malaria control strategies. Objective: Obtain and analyze data on subjective perceptions of risk.
 - Hypothesis 2.2: Identification of barriers to adoption of malaria control interventions provide means of tackling them. Objective: Analyze data addressing perceived barriers and policy implications

*Only ongoing work on Hypothesis 1.1 in presented here

study area (Fig. 1).



Figure1: Map of study area



- data will be collected as needed.
- 3,4,5)

4. Materials and Methods

> Study Area: is NSA comprising of ten countries- Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname and Venezuela. These countries account for approximately 90% of clinical cases in the region hence, the choice as

> Research Approach: Due to the complexity of malaria problem, I'm employing an interdisciplinary approach to address the problem (Fig. 2).

Materials: Raster data layers of environmental, climatic and anthropogenic parameters from satellite imageries, weather monitoring stations, global land cover and population data were collected from Worldclim, Digital Charts of the World, Globcover and Landscan. Vector data was collected from field sampling by our collaborators and the Walter Reed Biosystematics Unit. Sociological data would be collected through questionnaires to be administered in one of the study area. Other

Procedure: To test hypothesis 1.1, raster data of parameters that influence mosquito distribution (rivers, wetlands, urban areas, roads, population and elevation) were combined using a Multi-Criteria Evaluation in Idrisi GIS package. This produced a map of potential exposure to malaria vectors which is used as a proxy for risk of malaria transmission. All the data layers were gridded at 1km spatial resolution. A set of distance layers had been created for discrete factors using standard GIS operations. All factors were subsequently standardized into a continuous common numeric range on a byte 0-255 probability scale using a fuzzy function based on knowledge of mosquito interaction with the factor. Weights were generated for each factor based on the importance of the factor to malaria transmission by expert opinions and then assigned using Analytical Hierarchy Process. The risk maps produced were validated statistically using data on An. darlingi distribution and malaria case data from some parts of the study area. See preliminary results (Fig.

5. Preliminary Results

> Areas of high to moderate risk corresponded with locations of some of the anophelines collected.



Figure 3: Potential risk of exposure to malaria vectors across NSA (0 indicate little or no risk while 233 indicate high risk)

> Risk scores for mosquito occurrence points were significantly higher than those generated randomly (Fig. 4).



Figure 4: Plot showing the MCE risk values for randomly sampled points and for occurrence points of a DV, An. darlingi

6. Conclusion

Findings from preliminary results suggest that the MCE approach is a viable method to modeling spatial risk. The high resolution risk map produced aligned well with sampled vector points and may therefore be used to plan control of malaria vectors. Further analysis is planned to generate and validate risk maps with actual measures of malaria transmission, results of which could be used to plan containment of future outbreaks.

References

- WHO. (2007). MALARIA ELIMINATION: A field manual for low and moderate endemic countries
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- 4. Da Silva-Nunes, M., Moreno, M., Conn, J.E., Gamboa, D., Abeles, S., Vinetz, J.M., and Ferreira, M.U. (2012) Amazonian malaria: Asymptomatic human reservoirs, diagnostic challenges, environmentally driven changes in mosquito vector populations, and the mandate for sustainable control strategies. Acta Tropica 121 (3): 281-29

Multi-scale Modeling and Assessment of Malaria Risk in Northern South America

Alimi, T. O.1; Fuller, D. O.1,2 and Beier, J.C.1,3

INTRODUCTION

Malaria as a public health problem has become a priority for control efforts worldwide. The global consensus is that its elimination is crucial for continual development. Ongoing research projects in different regions, including South America (SA), try to improve our understanding of the disease dynamics. Their goal is to establish a new framework that would lead to new intervention strategies for malaria elimination in areas where the disease is seasonal. One of such investigations is undertaken by the International Centers of Excellence in Malaria Research (ICEMR) under a National Institutes of Health grant.

While only about 3% of the global malaria burden is borne by SA1, undertaking malaria research in the region is currently important because an estimated 23million people are still at risk 2 and approximately about 80% of clinical cases are found in Northern South America (NSA) 3.A key factor limiting eective control is lack of data and uneven implementation of control measures, including use of bednets, sprays, early diagnosis, and treatment. As part of the ICEMR investigation, this project seeks to model the spatial patterns of malaria risk in NSA through vector distribution and land-use changes. Furthermore, I intend to investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.

SIGNIFICANCE

Spatial distribution of malaria risk is still perceived as broadly categorized by the WHO's traditional risk maps which are highly generalized, of low resolution and have broad categories with uncertain boundaries (see da Nunes-Silva et al. 2012.). There is need for up- to-date high resolution risk maps which can aid malaria control eorts. Secondly, modeling distribution of principal malaria vectors and land use changes which may explain the observed distribution and risk are useful tools which would guide future management strategies. Finally, understanding the perceptions of at risk populations may help address barriers to adoption of interventions and influence policies. Overall, findings will empower NMCPs to achieve elective control and move them closer to elimination

AIMS

Specific Aim 1: Model the spatial patterns of malaria risk through vector distribution and land use changes

- Hypothesis 1.1: GIS-based Multi-Criteria Evaluation (MCE) model can accurately predict spatial extent of malaria risk areas. Objective: Generate risk maps that represent risk of malaria transmission
- Hypothesis 1.2: The Maximum Entropy (Maxent) model can accurately depict actual and predict. potential distribution of three Anopheles species. Objective: Model observed and potential spread of An albimanus, An darlingi , and An nunextovari.
- Hypothesis 1.3: Land- use changes can explain the variations in predicted malaria risk. Objective: Characterize land use land cover (LULC) and investigate changes in areas of risk.

Specific Aim 2: Investigate the perceptions of malana risk in order to identify barners to adoption and how they can be circumvented.

- · Hypothesis 2.1: Knowledge of perception of malaria risk can aid design of malaria control strategies. Objective: Obtain and analyze data on subjective perceptions of risk.
- · Hypothesis 2.2: Identification of barriers to adoption of malaria, control interventions provide means of tacking them. Objective: Analyze data addressing perceived barriers and policy implications

*Only ongoing work on Hypothesis 1.1 in presented here

NSA comprising of ten countries - Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname and Venezuela. These countries account for approximately 90% of clinical cases in the region

> 500 KP4

Research approach: Due to the complexity of malaria problem, I'm employing an interdisciplinary approach to address the problem.



Materials: Raster data layers of environmental, climatic and anthropogenic parameters from satellite imagenes, weather monitoring stations, global land cover and population data were collected from Worldcim, Digital Charts of the World, Globcover and Landscan Vector data was collected from Deld sampling by our collaborators and the Walter Reed Biosystematics Unit. Sociological data would be collected through questionnaires to be administered in one of the study area. Other data will be collected as needed.

Procedure: To test hypothesis 1.1, raster data of parameters that inence mosquito distribution (rivers, wetlands, urban areas, roads, population and elevation) were combined using a Multi-Criteria Evaluation in Idrisi GIS package. This produced a map of potential exposure to malana vectors which is used as a proxy for risk of malaria transmission . All the data layers were gridded at 1km spatial resolution . A set of distance layers had been created for discrete factors using standard GIS operations. All factors were subsequently standardized into a continuous common numeric range on a byte 0-255 probability scale using a fuzzy function based on knowledge of mosquito interaction with the factor Weights were generated for each factor based on the importance of the factor to malaria transmission by expert. opinions and then assigned using Analytical Hierarchy Process. The risk maps produced were validated statistically using data on An darling distribution and malaria case data from some parts of the study area. See preliminary results 13 UNIVERSITY OF MIAMI ABESS CENTER for ECOSYSTEM SCIENCE & POLICY

MATERIALS AND METHODS



RESULTS

Areas of high to moderate risk corresponded with locations of some of the anophelines collected.



Risk scores for mosquito occurrence points were significantly higher than those generated randomly.

Comparing mean of random and DV points for MCE risk map - p<0.05



CONCLUSION

Findings from preliminary results suggest that the MCE approach is a viable methods to modeling spatial risk. The high resolution risk map produced aligned well with sample vector points and may therefore be used to plan control of malaria vectors. Further analysis is planned to generate and validate risk maps with actual measures of malaria transmission, results of which could be used to plan containment of future outbreaks.

References

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Generative art by Nadieh Bremer





Jaime Serra Documental:

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Why should visualization be different?

