

An Areal Typology of Nasal Vowels in West Africa

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University of California, Berkeley

8th World Congress of African Linguistics (WOCAL8)

Aug 20-24, 2015

Kyoto University, Japan

$\Upsilon q \tilde{b} \tilde{l} \Delta_o t \nabla$ $\Upsilon q \tilde{l} \phi \tilde{\tau} H \tilde{\tau} m \tilde{l} q$ $\bar{l} \tilde{l} \tilde{Y} p \tilde{l} m p$

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Yq[~]Λ[~]I[~]Δ[~]o[~]±∇ Yq[~]I[~]φ[~]±[~]H[~]±[~]m[~]I[~]q I[~]I[~]Y[~]p[~]I[~]m[~]p

Contrastive nasal vowels in West Africa and Central Africa

- Nasality as a robust feature of West and Central African phonological systems
- Contributed significantly to previous descriptively and theoretically oriented Africanist work
- E.g. Hyman (1972), Williamson (1973), Maddieson (1984, 2007), Bole-Richard (1985), Clements (2000), Clements & Rialland (2006), Mieke (2013), among many others

Africa as (a) Linguistic Area(s)

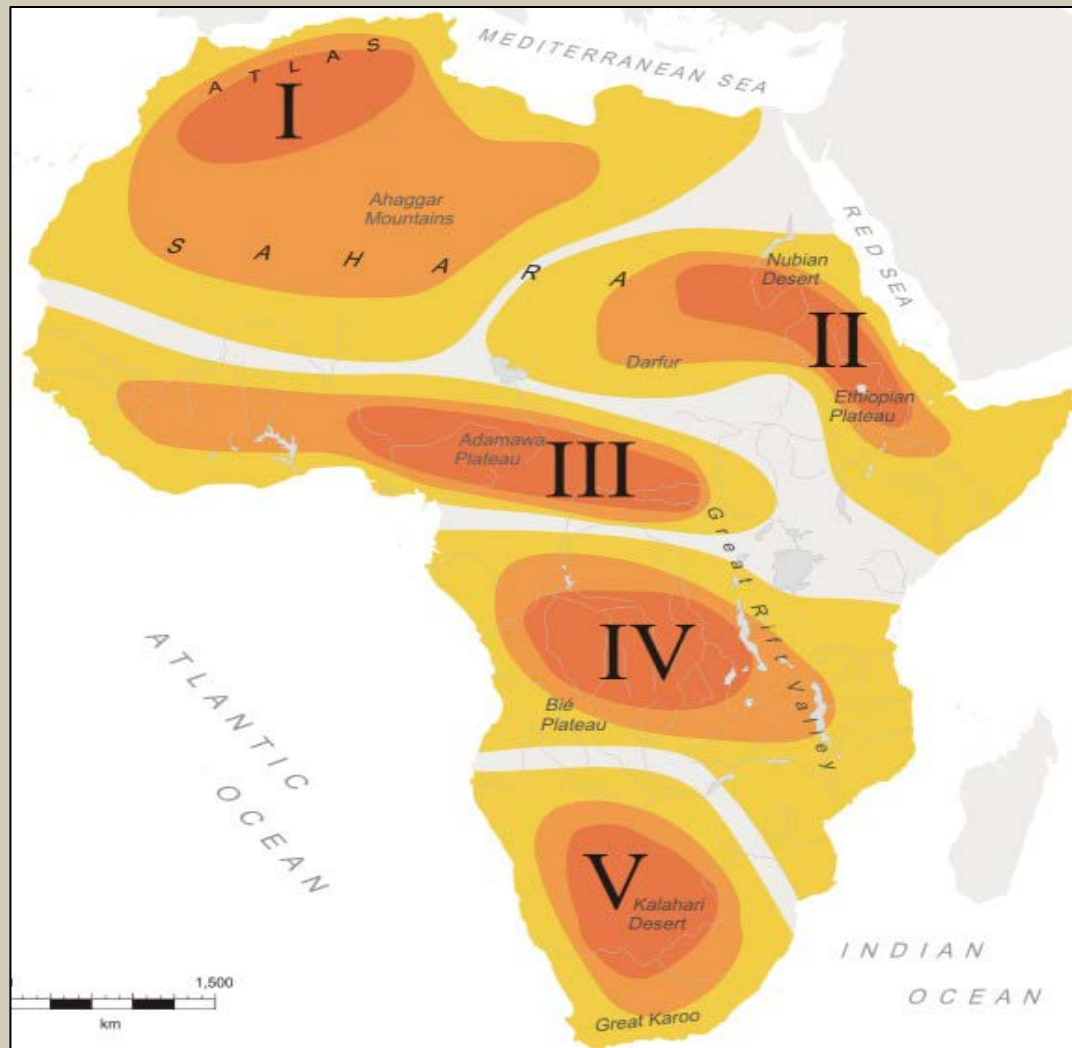
- Greenberg's (1959) work on “Africa as a Linguistic Area”
- Later work in Welmers (1973), Heine (1976), Gregersen (1977), Houis (1980), and Greenberg (1983)

Africa as (a) Linguistic Area(s)

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- Later work in Welmers (1973), Heine (1976), Gregersen (1977), Houis (1980), and Greenberg (1983)
- Nasality has been used to define certain linguistic areas within Africa
 - Large-scale areas of convergence which cut across genetic families

Güldemann 2008, 2010

- West African Area – “Macro Sudan Belt”



Areal Features

- (Macro) Sudan Belt Areal Zone - Clements & Rialland (2006), Güldemann (2008, 2010)
 - Serial verb constructions
 - Implosives
 - Labial-velar stops
 - More than two tone heights
 - ATR Harmony
 - **Nasal Vowels**
 - ...Among others
 - Certain tense/aspect systems (e.g. such as factative/performative marking)

Areal Features – Gaps!

- However, it is clear that there are numerous languages which exist within these areas which systematically do not display these areal properties
 - Languages without ATR (e.g. Esan – Edoid family)
 - Languages with SVCs (e.g. Kambari – Kainji Family)
- **Many languages lack nasal vowels**

Goals

- **[1] Africanist Goal** - Refining the Macro-Sudan Belt Linguistic Area
 - Establishing precise linguistic areas of shared linguistic features within this part of Africa
 - In which families do we find these patterns?
 - Establishing where specific subtypes of systems occur geographically
- **[2] Explanatory Goal** - To which factors can we attribute these patterns?
 - **Genetic** – Vertical inheritance
 - **Areal** – Horizontal spread
 - **Universal Phonetic** – Independent developments

Nasal Vowels - Previous surveys

Areal focus	Study	Total number of languages surveyed	Languages with contrastive nasal vowels	Percentage with nasal vowels
Cross-Linguistic	Ruhlen (1978)	700	150	21.4%
	Maddieson (1984) - UPSID	317	71	22.4%
	UPSID Updated	451	102	22.62%
	Maddieson (2007)	670	138	20.1%
	Hajek 2011a - WALS	244	64	26.2%
	World Phonotactics Database	3,776	723	19.1%
(West) Africa	Clements & Rialland 2006	150	Afr. Languages	26.7%
			W. Afr. langs.	34%
	Hajek 2011b - WALS	40	20	50%

Restrictions on Nasal Vowels

- Kwa/Benue-Congo restrictions on nasal vowels – Hyman (1972)
- Mid-high nasal vowel counterparts to oral vowels do not occur: */ẽ/, */õ/
- [n] (and sometimes [m]) does not occur before mid vowels: *[ne] ~*[nẽ], *[no] ~*[nõ]

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- Later works also commented on the lack of /ẽ õ/ across West Africa, e.g. Williamson (1973) (arguing against this generalization), Welmers (1973:32-33), Stewart (1983), Bole Richard (1985:13), Creissels (1994), Clements (2000:139), Vydrine (2004), and Güldemann (2010) → **Nothing Categorical**

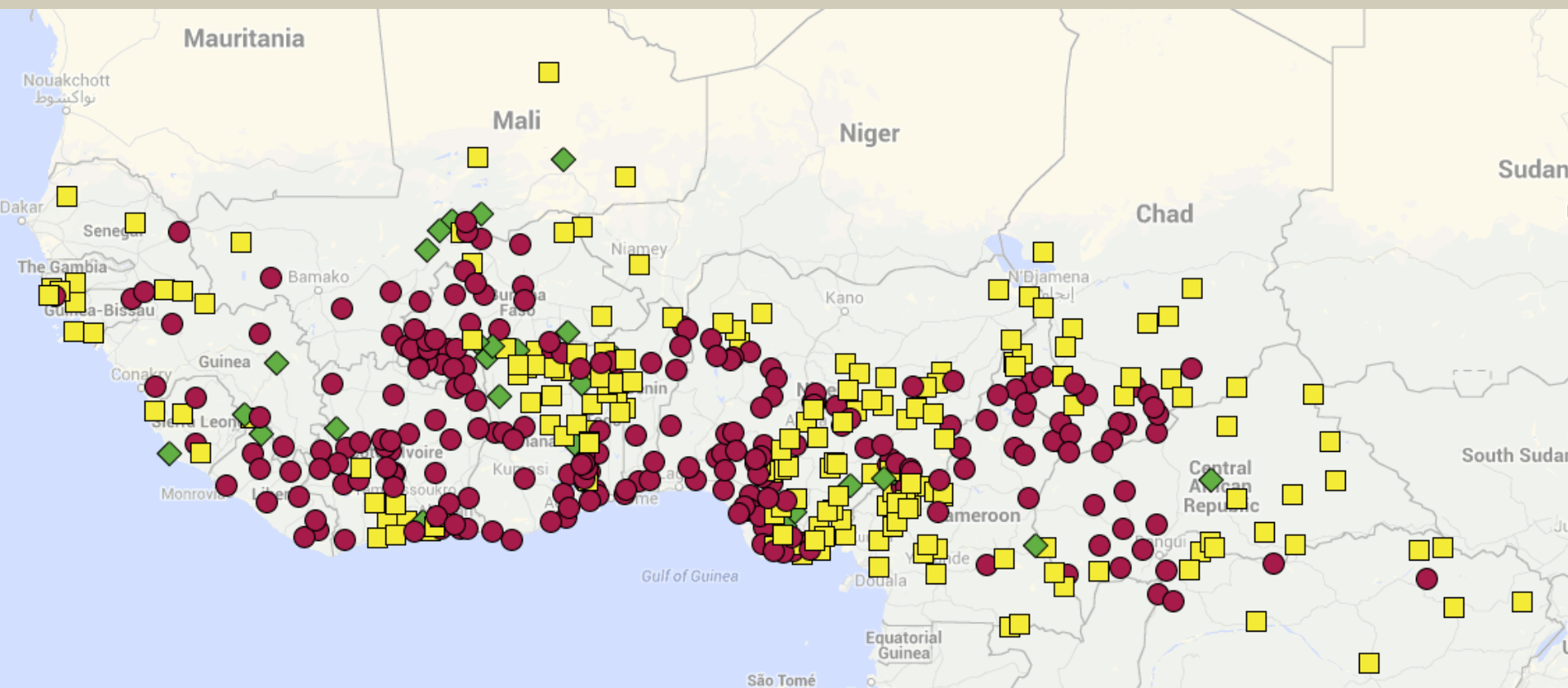
Expanding - Current Survey

- Phonological systems of West and Western Central African languages – 473 data points
- Major families: Atlantic, Mande, Kru, Gur (and Senoufo), Kwa, Benue-Congo (non-Bantu), Ijoid, Adamawa, Chadic, Ubangian (and Gbaya), Sara
- Survey is largest available
 - Genetic/areal profile
 - Presence / absence of contrastive nasal vowels
 - Missing nasal vowels

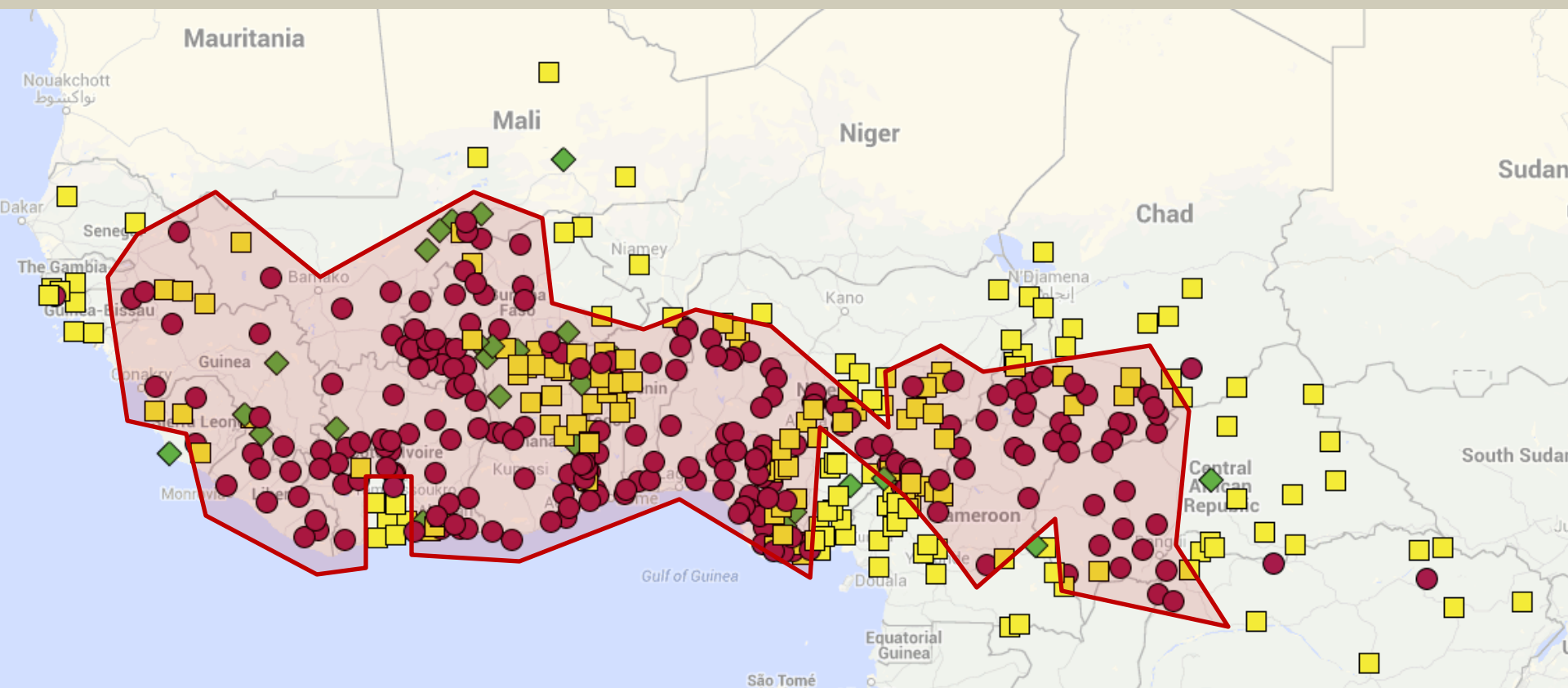
Statistics of West African “Languages”

Type	Contrastive Nasal Vowels	Stats n = 473
Nasal vowel languages	y	252 (53%)
Oral vowel languages	n	191 (40%)
Uncertain analyses	n~y	30 (6%)

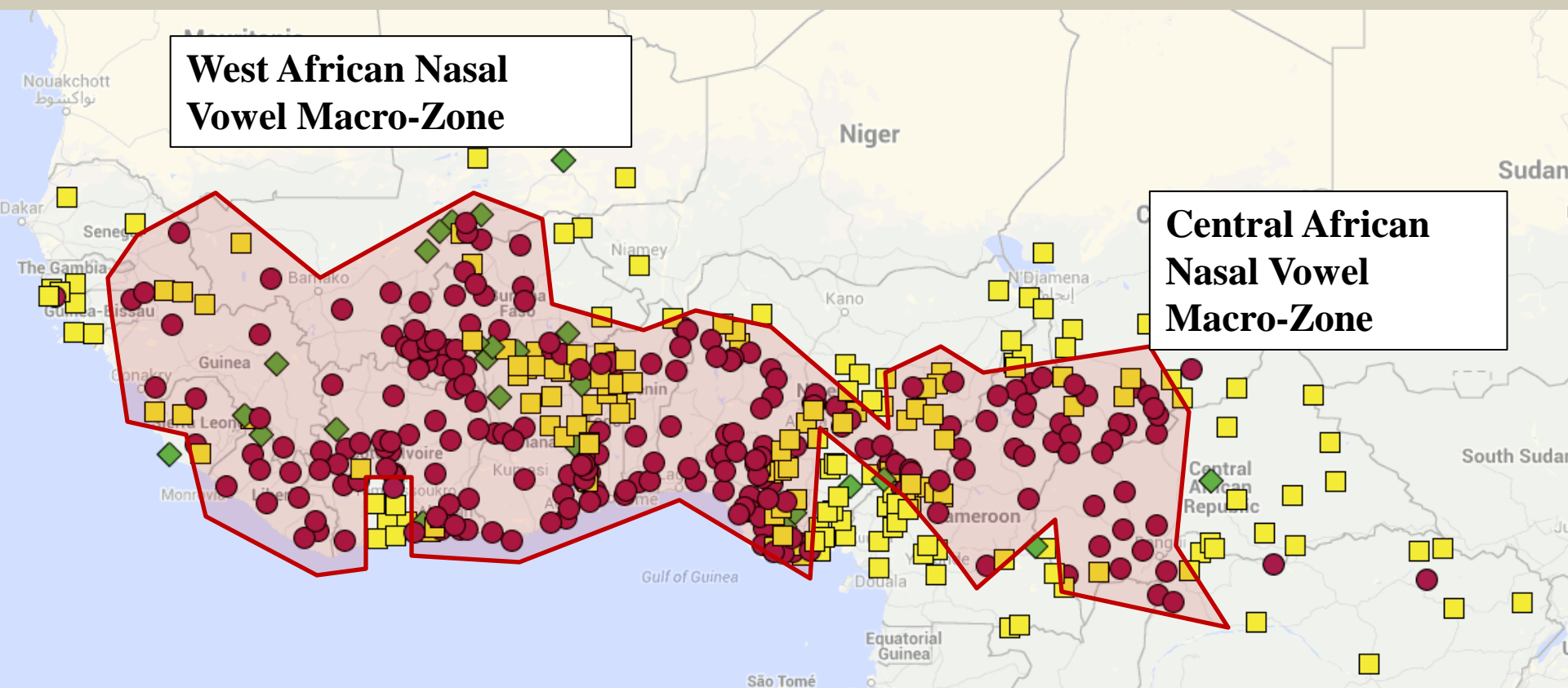
Presence/Absence of contrastive nasal vowels



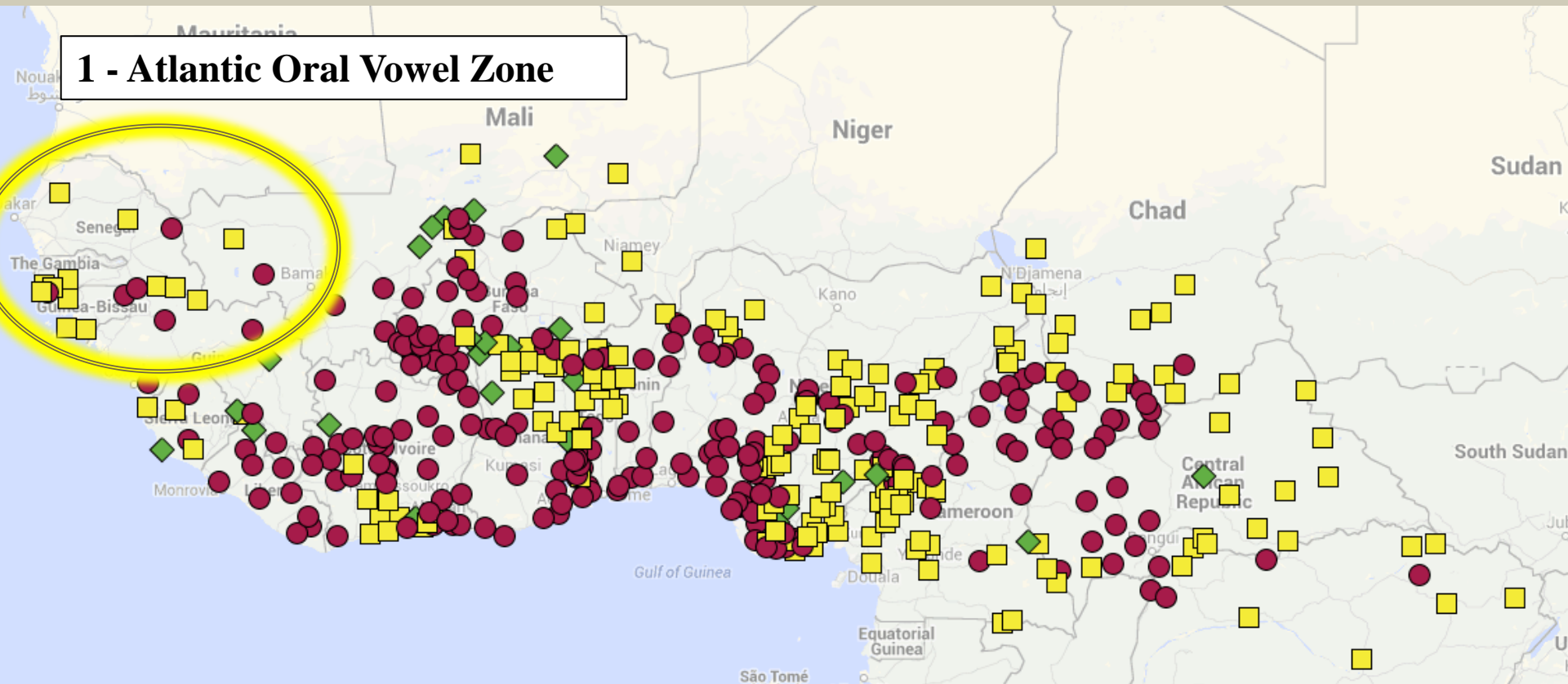
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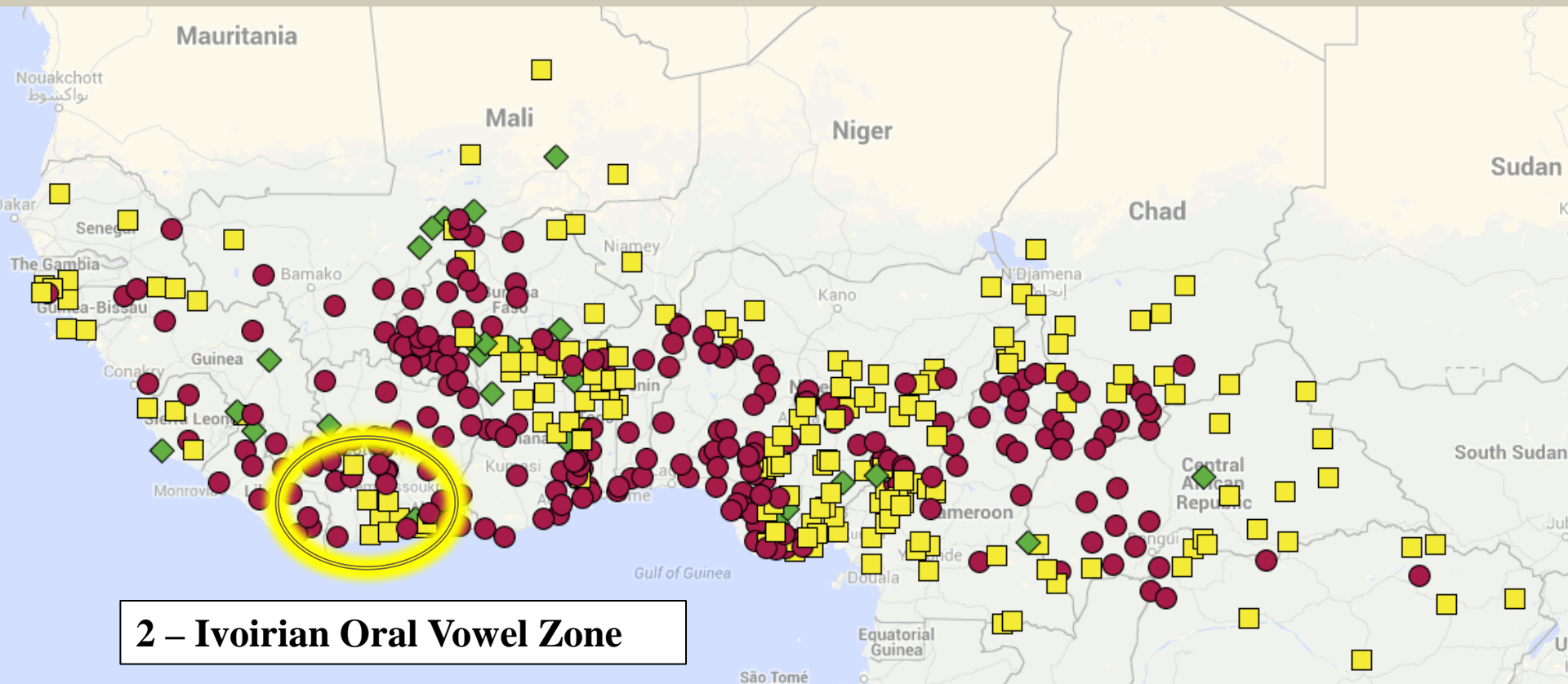
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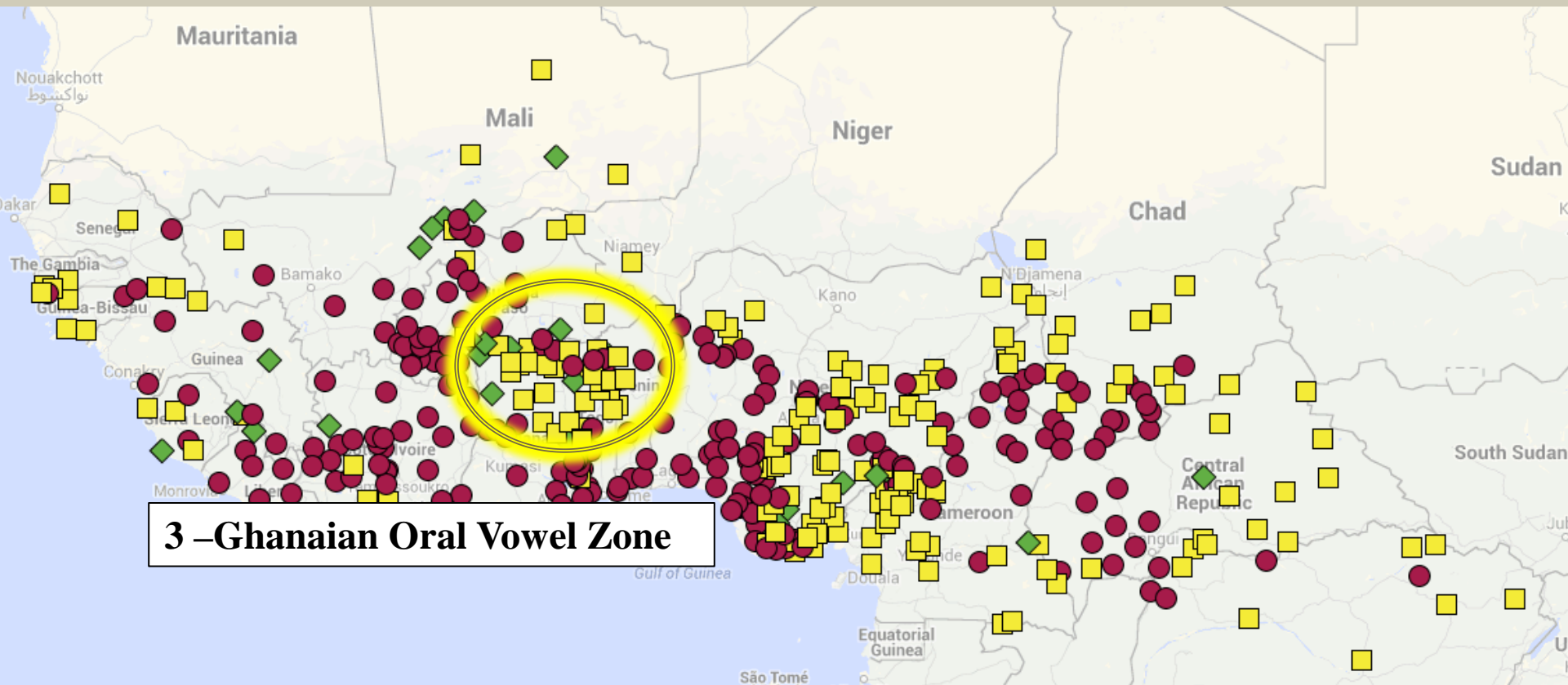
West Africa – Presence/Absence of contrastive nasal vowels



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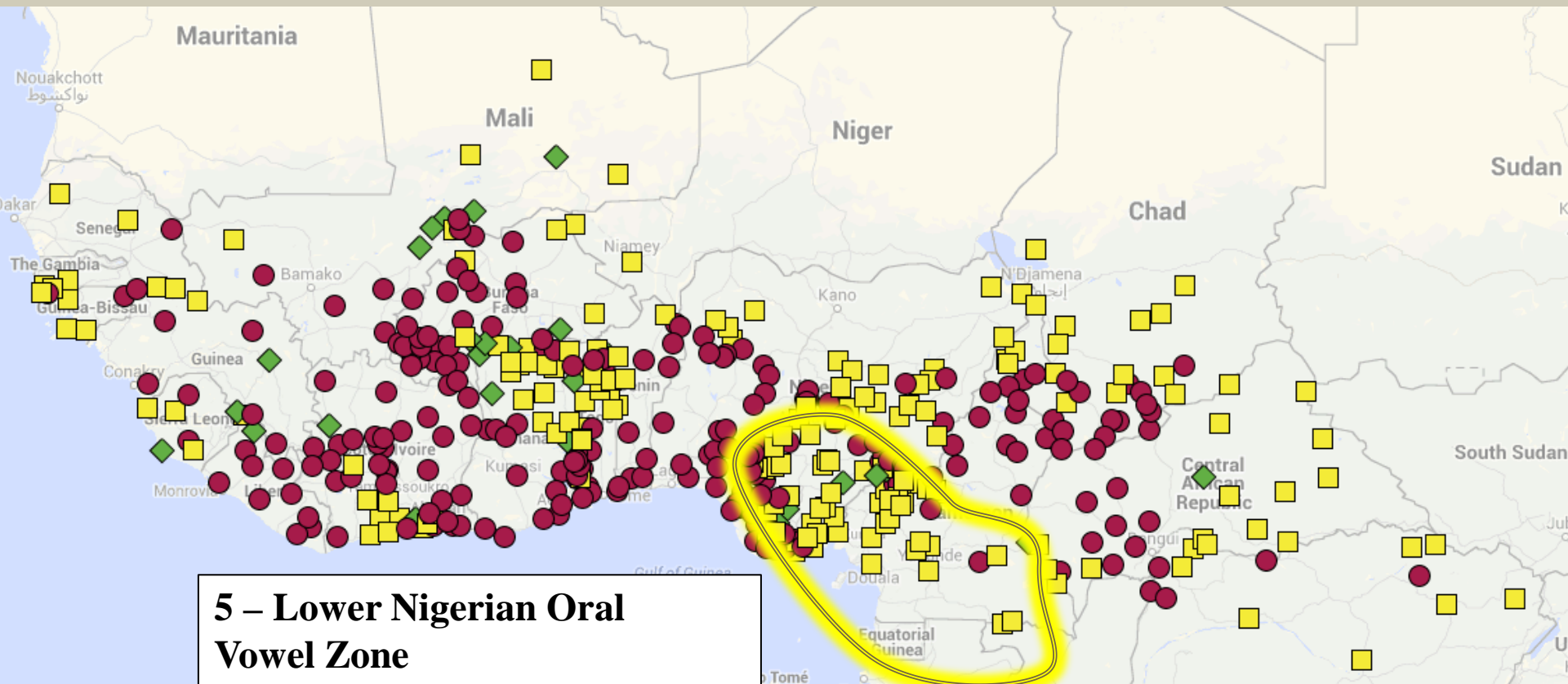
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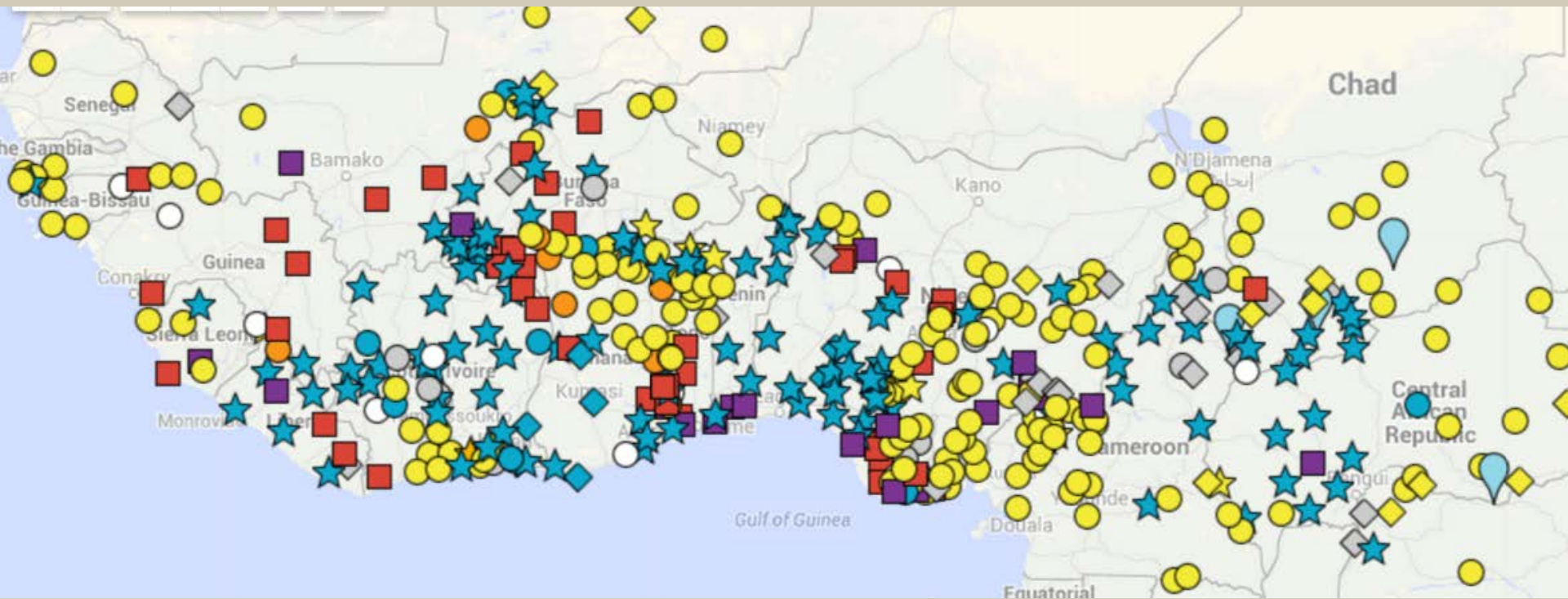
Individual types

- **Oral** – no contrastive nasal vowels
 - Noyo: /i ɪ e ε a ɔ o ʊ u/
- **Nasal** – no nasal counterpart missing
 - Bambara: /i e ε a ɔ o u/ /ĩ ẽ ɛ ã õ ã ã/
- ★ **Nasal** - / ẽ õ / missing
 - Edo: /i e ε a ɔ o u/ /ĩ ẽ ã õ ã/
- **Nasal** – no nasal V missing – restriction on ẽ õ
 - Some Ijọ lects: /ẽ õ/ found only in ideophones
- **Nasal** – other missing
 - Ebrie: /i e ε a ɔ o u/ / ẽ ã õ/
 - **Other Nasal**– e.g. those with only three heights, others
 - Soninke: /i e a o u/ /ĩ ẽ ã õ ã/

Individual types

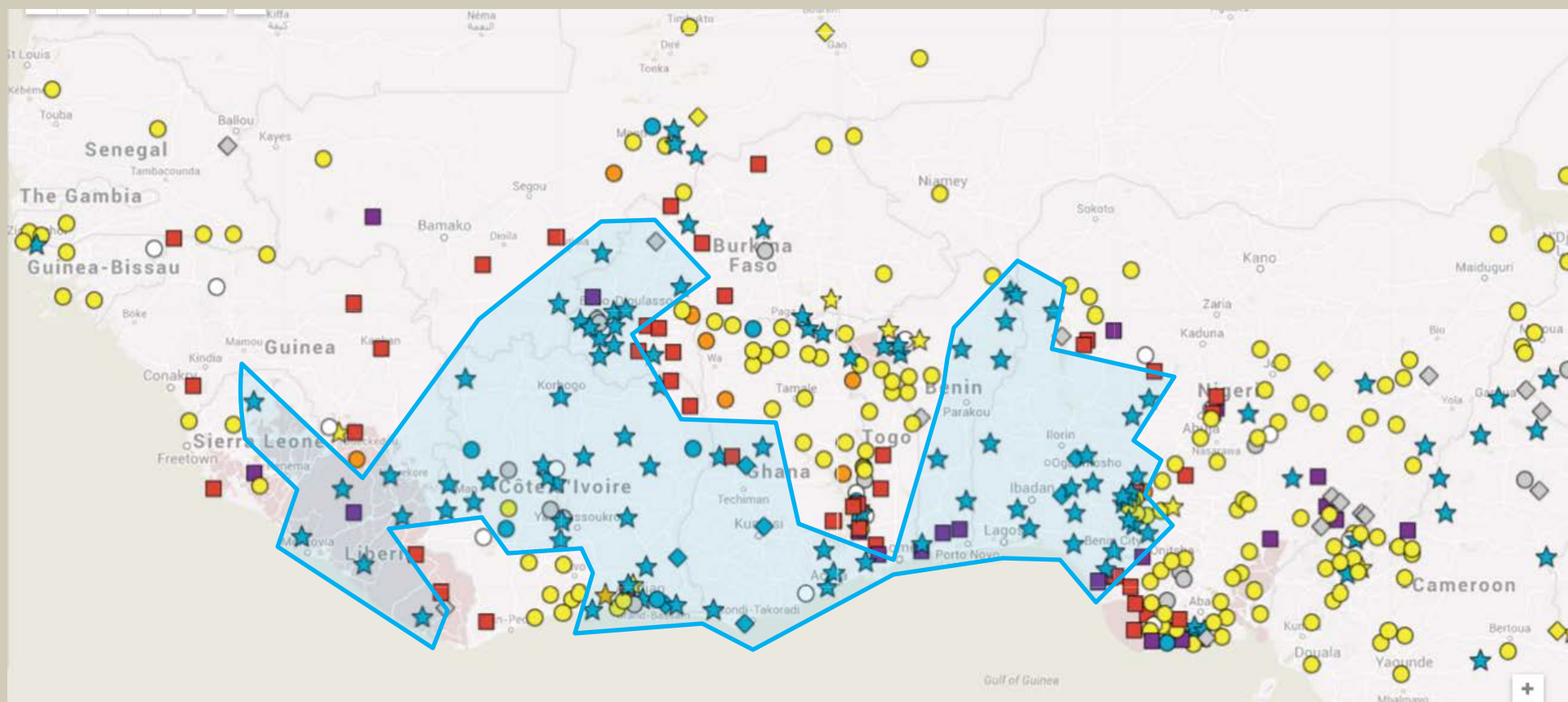
	Type	Total n = 256	Percentage	
	Nasal – None Missing	56	21.88%	30%
	Nasal – None Missing but restrictions on /ẽ õ/	21	8.2%	
	Nasal – Missing /ẽ õ/ in +7 vowel system	143	55.86%	56%
	Nasal – Other Missing	15	5.86%	14%
	Other	21	8.2%	

How are these patterns distributed?



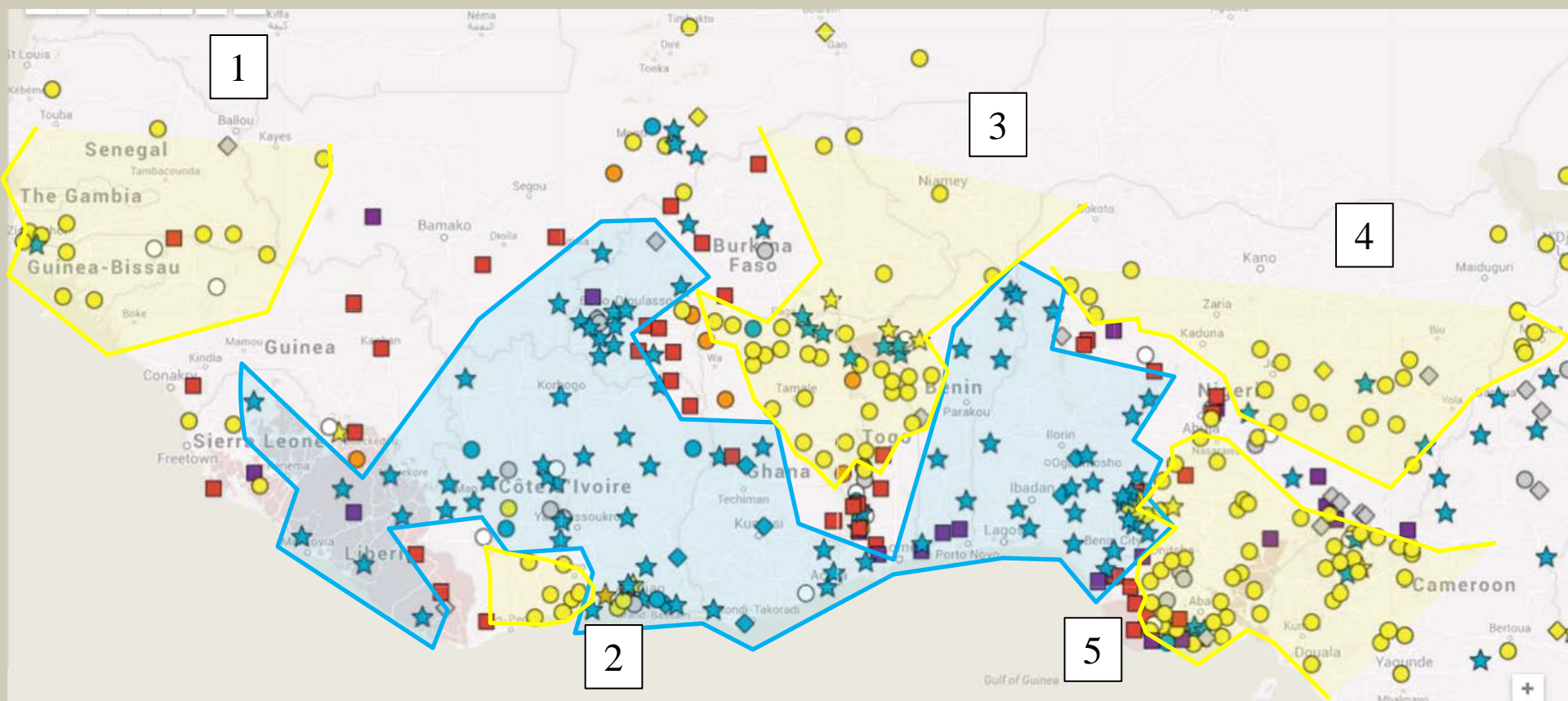
West African Nasal Vowel Macro-Zone

- West African Nasal Vowel Core - *ẽ õ



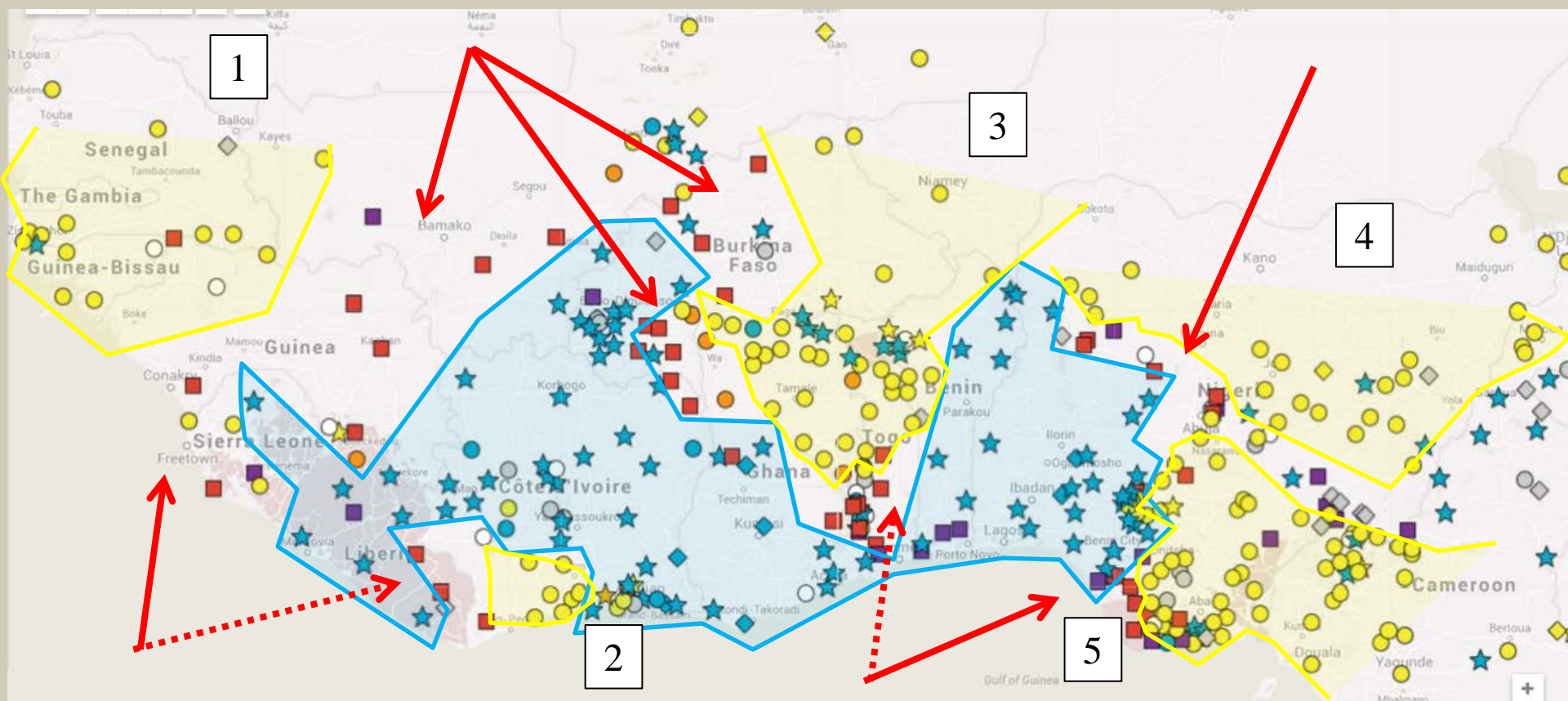
West African Nasal Vowel Macro-Zone

- West African Oral Vowel Zones



West African Nasal Vowel Macro-Zone

- Nasal Vowel Periphery – More common /ẽ õ/



Statistics – WAfr Nasal Vowel Systems

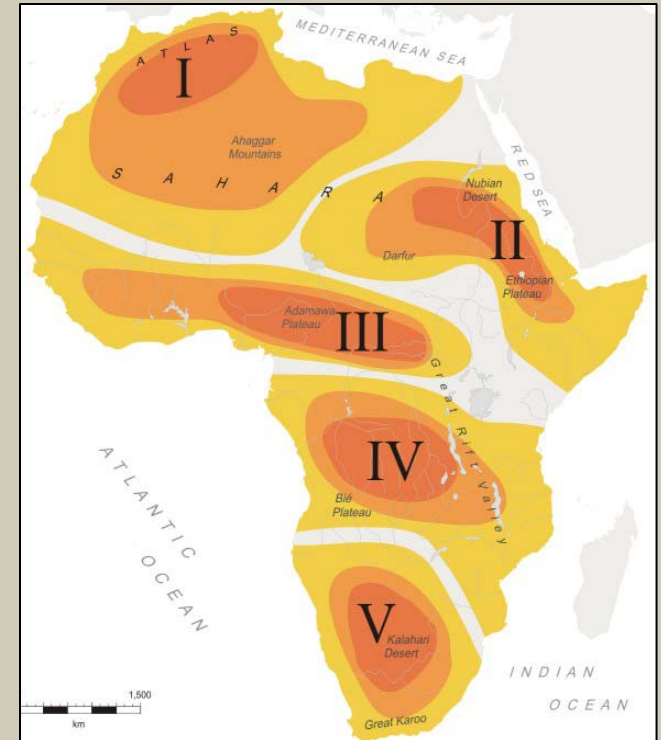
- Missing nasal vowel counterparts – Most likely to be absent
- **Likelihood being Absent (Oral Vowel present)**
- **Most Likely**

Mid-close	*ẽ *õ
+ATR Low	*ẽ
Near-high	*ĩ *ũ
Mid-open	*ẽ *õ
- **Least Likely**

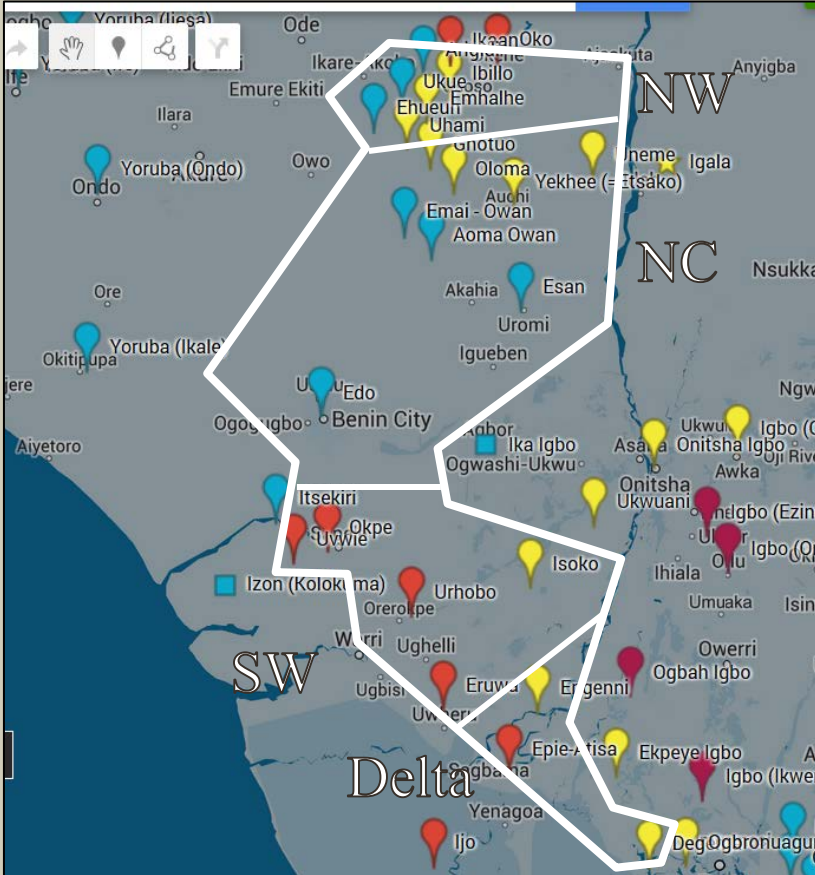
High & Low	*ĩ *ũ *ã
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Refining the Macro-Sudan Belt Linguistic Area

- Shows a more nuanced portrait of the West African Zone (cf. Guldemann 2008)
- Shows that a large part of the Macro Sudan Belt's Core has categorical absence of this areal feature
- Shows an (albeit limited) internal diversity of sub-types



Edoid Group (Benue-Congo)



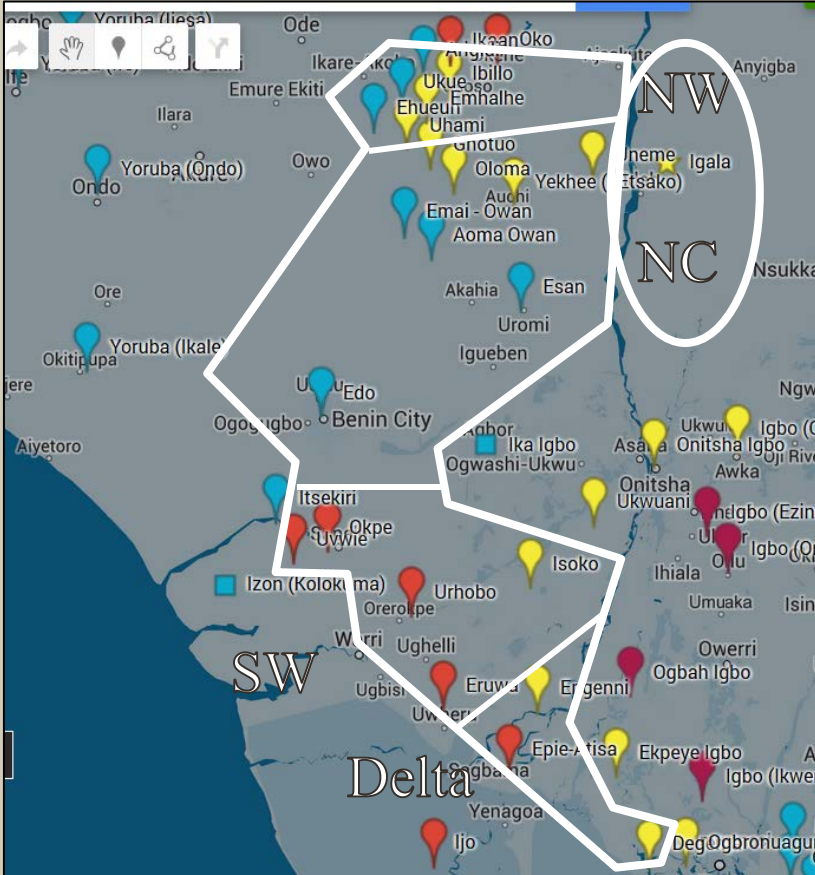
Edoid has four branches:

- Northwest
- North-Central
- Southwest
- Delta

They about many different families:

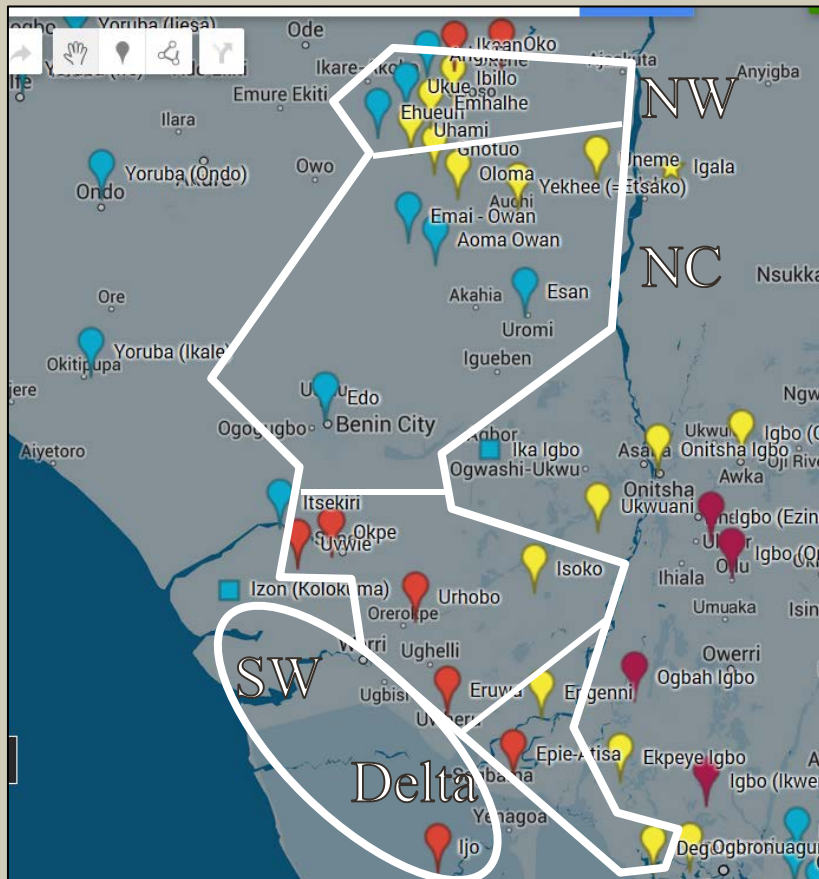
- Defoid, Ijoid, Idomoid,
Igboid, Cross River, Other

Edoid Group (Benue-Congo)



- North-West North Central:
 - Within sphere of westerly located and powerful Yoruba
 - Lacks /ẽ õ/
 - Edoid languages align
 - Ehueun and Ukue (NW)
 - Edo (=Bini), Esan and Owan languages (NC)
- Languages to east:
 - Next to Oral Vowel Zone 4
 - Do not have contrastive nasal vowels
 - Ibillo (=Okpamheri), Emhalhe, Uhami, Oloma (NW)
 - Ghotuo, Yekhee (=Etsako), and Uneme (NC)

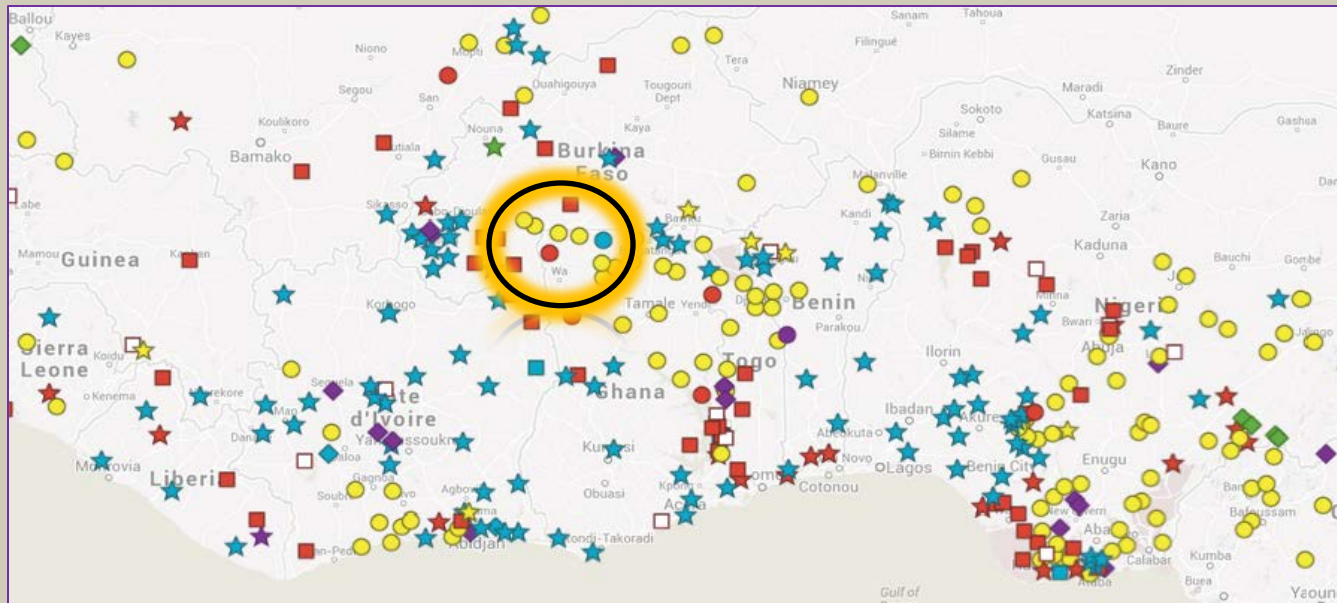
Edoid Group (Benue-Congo)



- Southwest and Delta Edoid:
 - Westerly located languages have full set of nasal vowels across both branches
 - These abut Ijoid languages which also have a full set
 - [Izon does but \tilde{e} \tilde{o} only in ideophones]
 - Easterly located have no nasal vowels
 - Degema adjacent to Cross River language Ogbronuagum which also lacks nasal vowels

Incipient Phonemic Nasal Vowels

- **Dagaare/Dagara**
- Northwest Ghana / Southwest Burkina Faso region



Incipient Phonemic Nasal Vowels

- **Dagaare/Dagara** - occur at the same zones where we find a full set of nasal vowels
- Depending on the author and the dialect , nasal vowels are interpreted as either (1) allophonic variants of /VN/ sequences, or (2) phonemically contrastive units
- Unsure whether it is nasalized vowels of /Vm/ sequences (Kropp Dakubu 1976)

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- Among specialists, conclude Allophonic / Non-Contrastive
 - Delplanque (1983, 2012 [Cited in Mieke 2013]) , Some 2003, Nakuma 1998:172-175

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- Among specialists, conclude Allophonic / Non-Contrastive
 - Delplanque (1983, 2012 [Cited in Mieke 2013]) , Some 2003, Nakuma 1998:172-175
- In <dàgàárī> and <wáálí̄> dialects, there is surface variation between a nasal vowel and a coda nasal
 - [bíí̄] ‘ou bien’; [bíí̄̃] ~[bíín] ‘bouillon’
 - [vũũ̄]~[vùú̃ŋ] ‘feu’

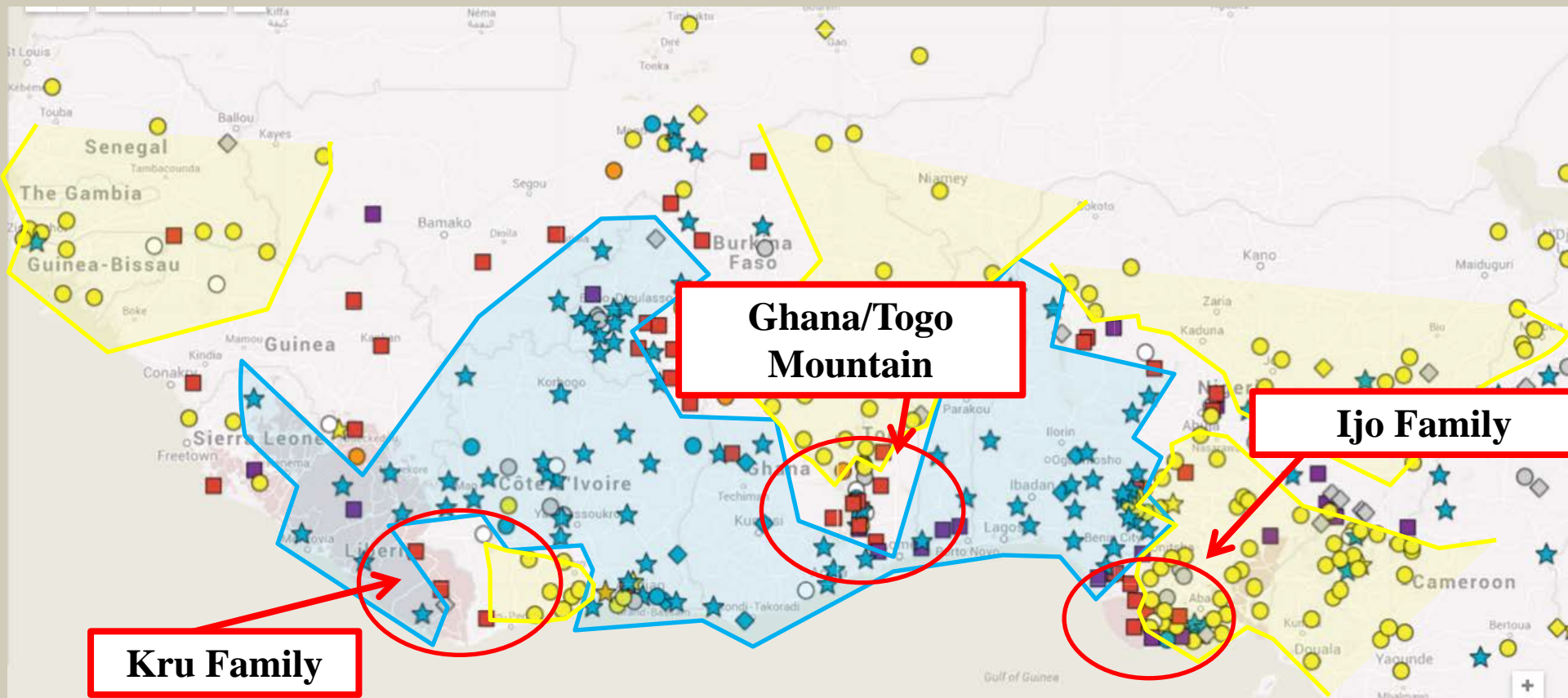
Incipient Phonemic Nasal Vowels

- **Dagaare/Dagara** - occur at the same zones where we find a full set of nasal vowels
- Full set of nasal vowels occur at transition zones
- What is important here is that surface contrast between [õ] vs. [õ̃] in the <lòbr> and <wúle> dialects.
 - [kò] ‘sécher’ vs. [kõ̃] ‘pleurer’
 - [pwó] ‘participer’ vs. [pwõ̃] ‘pourrir’
- Dagara dialect: [gbẽẽ] “forehead” vs. [gbẽgbẽ] “long”

Full Inventory as transition type

- Full Inventory type is a transition type from Oral Vowel System to Nasal Vowel system
- Unstable and infrequent in West Africa
- **Larger question:** can we use the occurrence of full nasal vowel systems in an area to help “date” the phonemicization of nasal vowels in a specific area?

Full Inventory Type – Bad news: a shrinking sample size



Kru [Cote D'Ivoire]

- Transition area between West African Nasal Vowel Macro-Zone and Ivoirian Oral Vowel Zone [2]
- Kru: Krahn, Tepo Krumen, the Cedepo dialect of Grebo, Wobe, and Nyabwa
- Marchese-Zogbo (n.d./2012)
 - later work says that Western Kru languages Nyabwa, Wobe, Guere, Klao, Bassa altogether lack /ẽ õ/
 - Reconstructs Proto-Western Kru having oral */ɪ ɛ ɛ̃ a ɔ o u/ and nasal */ĩ õ ẽ ã ã̃/, but no /ẽ õ/
 - Some difficulty in establishing as [ũ] or [õ] in some cases

Ghana/Togo Mountain

- Transition area between West African Nasal Vowel Macro-Zone and Ghanaian Oral Vowel Zone [3]
- Heine's (1968) survey of this area (later repeated in Williamson 1973) may include many non-contrastive nasal vowels, therefore inflating number of full inventory systems in this area
- E.g. Dingemanse (2011:98) notes that “There are seven oral and five nasalised vowel phonemes in Siwu. Heine lists seven nasalised counterparts, but in my data /ẽ/ and /õ/ do not occur (cf. also Ford and Iddah 1973:6; Ring, Addae, and Atsu 2002a:17).”

Phonetic Perspective

- **Phonetic literature:** more or less consensus that nasality affects the perception of vowels
- **Nasal vowels:** systematic lowering of the velum
- Airflow through both the oral and nasal cavities
- Each of these resonance cavities is associated with its own formant/spectral profile
- Results in an acoustic coupling of both the oral and nasal tract (Maeda 1993)
- **“Oral-Nasal Coupling”**

Phonetic Perspective

- Coupling effects said to result in perceptual “blurring” of different vowel qualities (Ohala 1975).
- Most prominent within the first formant (F1), the main correlate of perceived vowel height

Nasal Height-Centralization Effect

- The “shifts in the low-frequency center of gravity due to nasalization influence perceived vowel height” (Beddor 1993: 181),
 - **Nasal Height-Centralization Effect**
- This effect results in high and mid vowels being perceived as lower in the vowel space (e.g. /i/ as [ɪ]), and low vowels are being perceived as higher (e.g. /a/ as [æ])

Nasal Height-Centralization Effect

- Listener-driven changes show that listener misperceptions can be a source of phonological change
- Nasal vowels: speakers perceive differences in F1 -
 - Attribute to tongue height rather than (purely) nasal coupling (Beddor et al. 1986:203)
- Diachronic effects
 - Chain shifts within the acoustic vowel space (e.g. famously in the history of French, *ĩ > *ẽ, ẽ > *ẽ̃ – Carignan 2013:142)
 - Mergers of contrast resulting in the reductions in height contrast we see in many vowel inventories (Wright 1986:46, Schwartz et al. 1997:237, Kingston 2007:417).

Nasal Height-Centralization Effect

- Gap in [ẽ õ] as a result, in part, from the perceptual Nasal Height-Centralization Effect
- Distinction between /ẽ õ/ and /ẽ õ/ being perceptually unstable (as discussed in Foley 1975, Wright 1980, Maddieson 1984, Capo 1985b:114)

Against Determinism of Nasal Height-Centralization Effect

- Nasal Height-Centralization Effect
 - Also predicts lowering of high vowels, and raising of low vowels
- Multiple values within high and low
 - Numerous languages in West Africa have a contrast between /i u/ vs. /ɪ ʊ/, typically in terms of ATR/RTR
 - Numerous also have /ə/ vs. /a/ distinction in the low vowel field
- Many of these languages also have nasal vowels – **what gaps do we find?**

Nasal vowel languages with High [ATR]/[RTR] contrast

Nasal vowel pattern type	Number (N = 60)	Oral	Nasal
Maintain distinction	43	/i ɪ u ʊ/	/ĩ ã ü õ/
Lower value ([RTR]) missing	11	/i ɪ u ʊ/	/ĩ ü/
Higher value ([RTR]) missing	1	/i ɪ u ʊ/	/ĩ õ/
No nasal high vowels	5	/i ɪ u ʊ/	-

- Most maintain distinction (allow crowded space with this contrast)
- If one is missing, **lower value is missing**

Nasal vowel languages with Low [ATR]/[RTR] contrast

Nasal vowel pattern type	Number (N=29)	Oral	Nasal
Maintain distinction	21	/ə a/	/ẽ ã/
Lower value ([RTR]) missing	1	/ə a/	/ẽ/
Higher value ([RTR]) missing	6	/ə a/	/ã/
No nasal low vowels	1	/ə a/	-

- Most maintain distinction (allow crowded space with this contrast)
- If one is missing, **lower value is missing**
- **Complication:** /ə/ often a “*marked*” vowel in some way

Dispersion?

- Most straightforward interpretation is that the high and low vowel heights are subject to dispersion
 - Value which has most distinct formant profile will be preferred
 - Higher value in high vowels, Lower value in low vowels
- Mid vowel height – not subject to such dispersion pressures

Further evidence against determinism with Height Centralization Effect

- **Synchronic evidence - Not even contextual nasalization of [ẽ õ]**
- **Kyanga** (Northern Benin/Nigeria border) nasalization is said to “continue through the following adjacent vowels” from preceding nasal consonants, “except ‘o’ and ‘e’ which are never nasalized” (Jones 2010:12).
- **Mbe** dialect Ogberia , automatic nasalization occurs with all vowel qualities after nasal consonants. However, automatic nasalization occurs before nasal consonants for all qualities except /e o/ (Chumbow 1987).
- **Anyi** - Koffi (1990[2009 updated]: 94-6) - oral vowels /e ɛ o ɔ/ do not have nasal phoneme counterparts, and in fact are “unnasalizable” *[ẽ ẽ õ õ]
- **Igala** - an Oral Vowel language - Omachonu (2000:25) notes that /e o/ do not become nasalized in the context of a nasal consonant, unlike the other 5 vowels /i ɛ a ɔ u/

Further evidence against determinism with Height Centralization Effect

- **Diachronic Evidence – raising of /ẽ õ/ rather than lowering**
- **Yoruboid/Defoid family** [Benue-Congo: Nigeria] (Capo 1985b:106) notes that Yoruba dialects have a 7 oral vowels /i e ε a ɔ o u/, with a reduced number of nasal vowel correspondents
- Capo reconstructs proto-Yoruba phonemes */ẽ õ/ which have reflexes of /ĩ ã/ and /ũ ã/ in the modern dialects, counterpart to proto oral */e o/
- **Boko/Busa language cluster** - /i e ε a ɔ o u/ /ĩ ã ã ã ã ã/, with missing */ẽ õ/ counterparts (Jones 1998)
- A new variety called “New Busa” is emerging in this area, which is highly influenced by Hausa (an unrelated Chadic lingua franca)
- Oral vowels /ε ɔ/ merge with higher /e o/, whereas nasal vowels /ẽ õ/ merge with perceptually dissimilar /ĩ ã/ (Jones 1998:26)
 - These do not become nasal vowels /ẽ õ/

Summing Up

- [1] There exist two large, contiguous Nasal Vowel areal zones – **West African Nasal Vowel Macro-Zone** and **Central African Nasal Vowel Macro-Zone**
- [2] There also exist five **Oral Vowel Zones** 1-5
- [3] The West African Zone can be divided into two parts
 - Nasal Vowel Zone Core and Zone Periphery
- [4] Core show almost categorical absence of nasal vowels /ẽ õ/
- [5] Languages in the periphery more varied in terms of presence/absence of /ẽ õ/
- [6] Phonetic research predicts a gap of /ẽ õ/
 - However phonetic determinism is not invoked here as certain other predictions are not borne out by W. African patterns

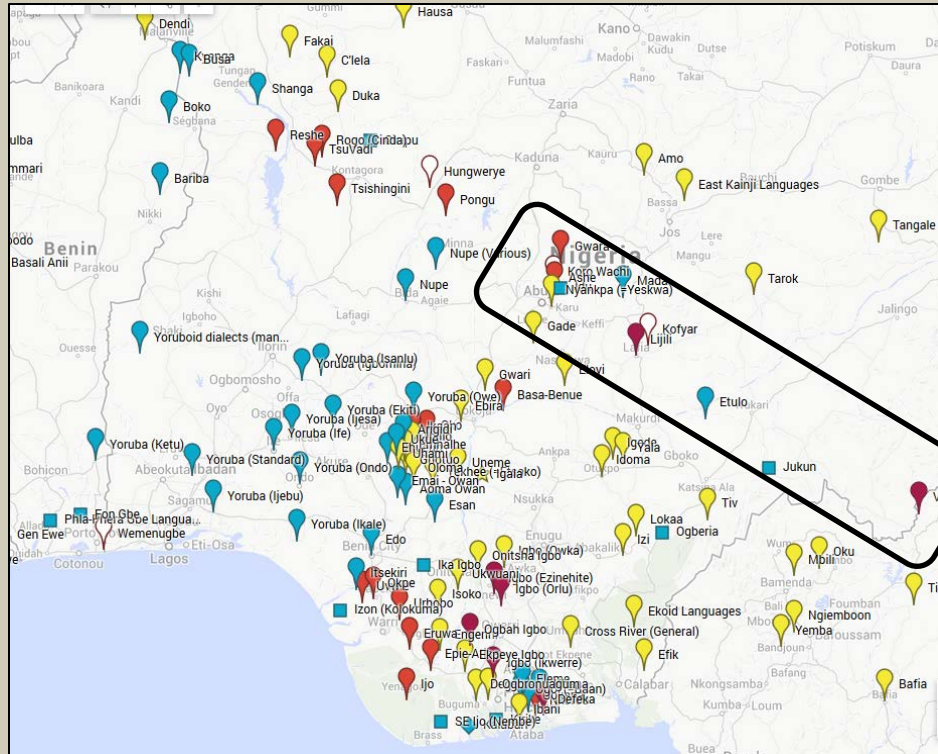
Still to Do

- Ensure data is correct
 - Find additional sources
 - E.g. in Ghana in particular, many new descriptions have come out which challenge earlier phonological inventories
- Fully incorporate information from Central African languages - **currently being done**
- Compare to a larger world-wide sample

References and Contact

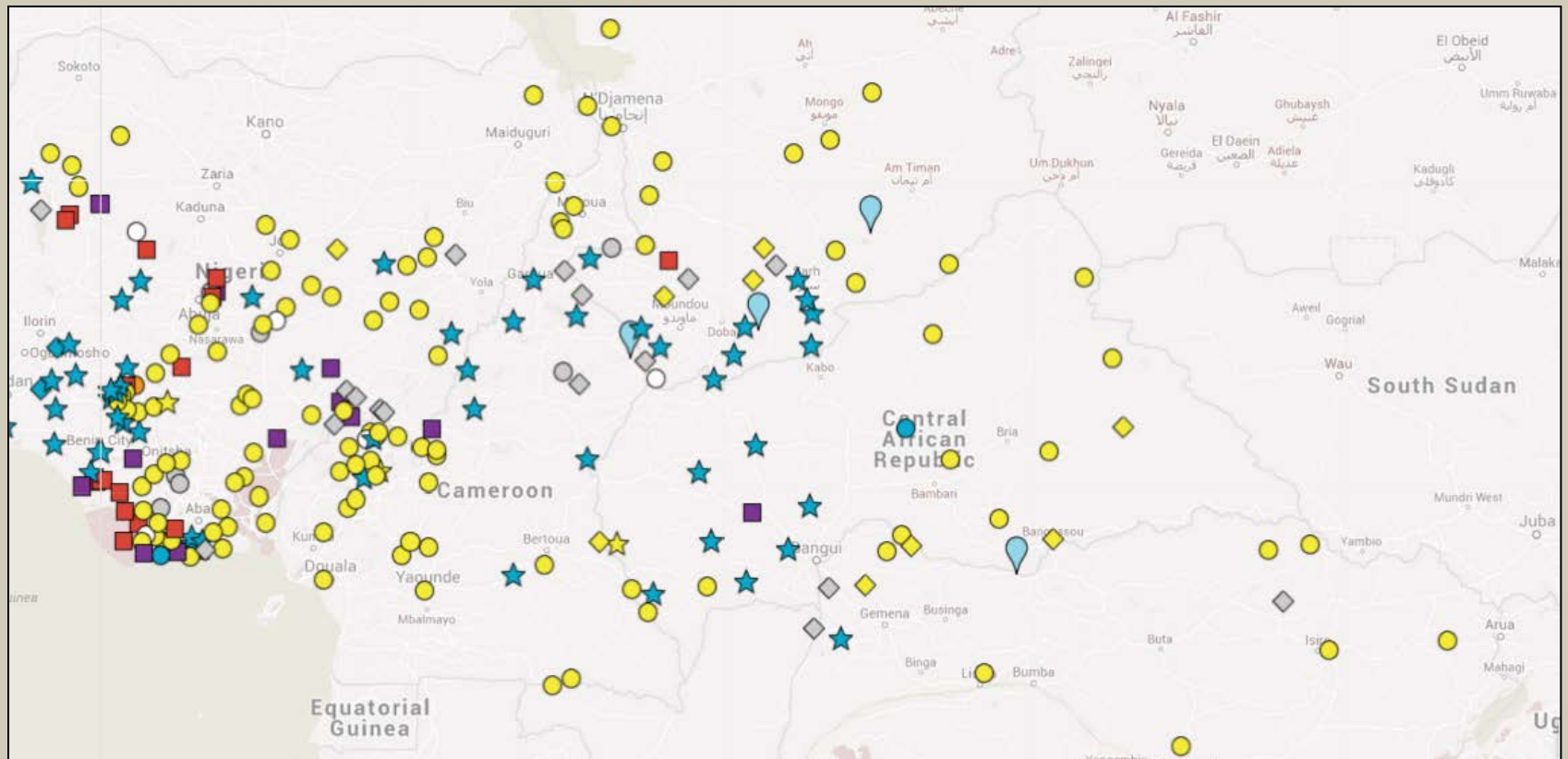
- Please contact me for full references, or for a copy of these slides
- n.rolle@berkeley.edu

Central Nigeria nasal vowel belt

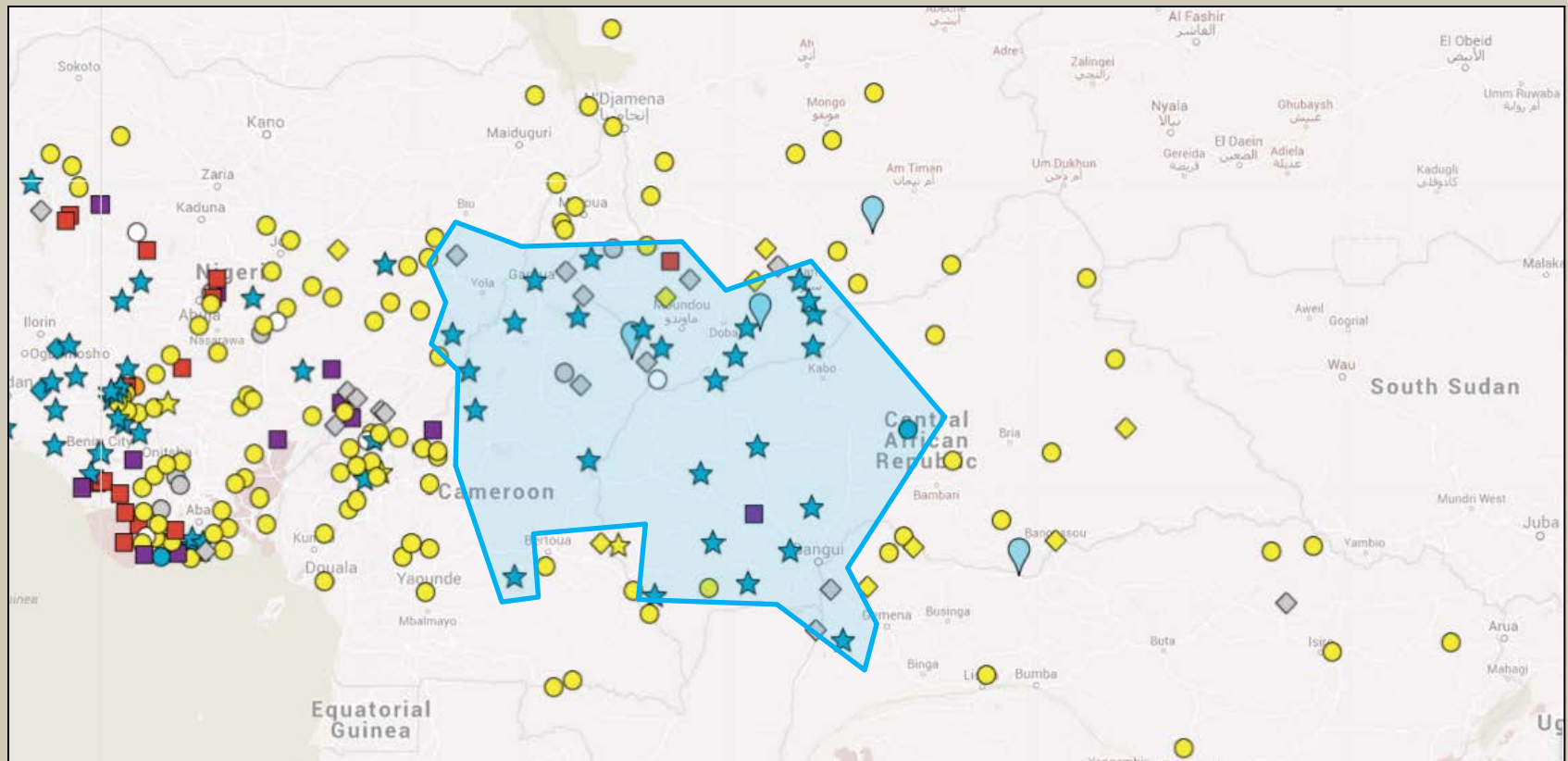


- Contiguous belt of nasal vowel languages from different families starting near modern day Abuja
 - Gwara, Mada, Lijili [all Plateau languages]
 - Etulo [Idomoid]
 - Jukun [Jukunoid, Benue-Platoid]
 - Vute [Mambiloid, Northern Bantoid]
 - Ncane [Beboid]
 - Kofyar? [Chadic]

Central Africa



Central Africa



Central African Nasal Vowel Macro Zone - Observations

- [1] The isogloss is very clear
- [2] Cuts across language families – but impressionistically to a lesser degree than in West Africa
- [3] Virtual absence of nasal vowel systems with full inventory
- [4] Virtual absence of nasal vowel systems with /ẽ ã/
- [5] There is a narrow nasal vowel “corridor” between two Nasal Vowel Macro-Zones

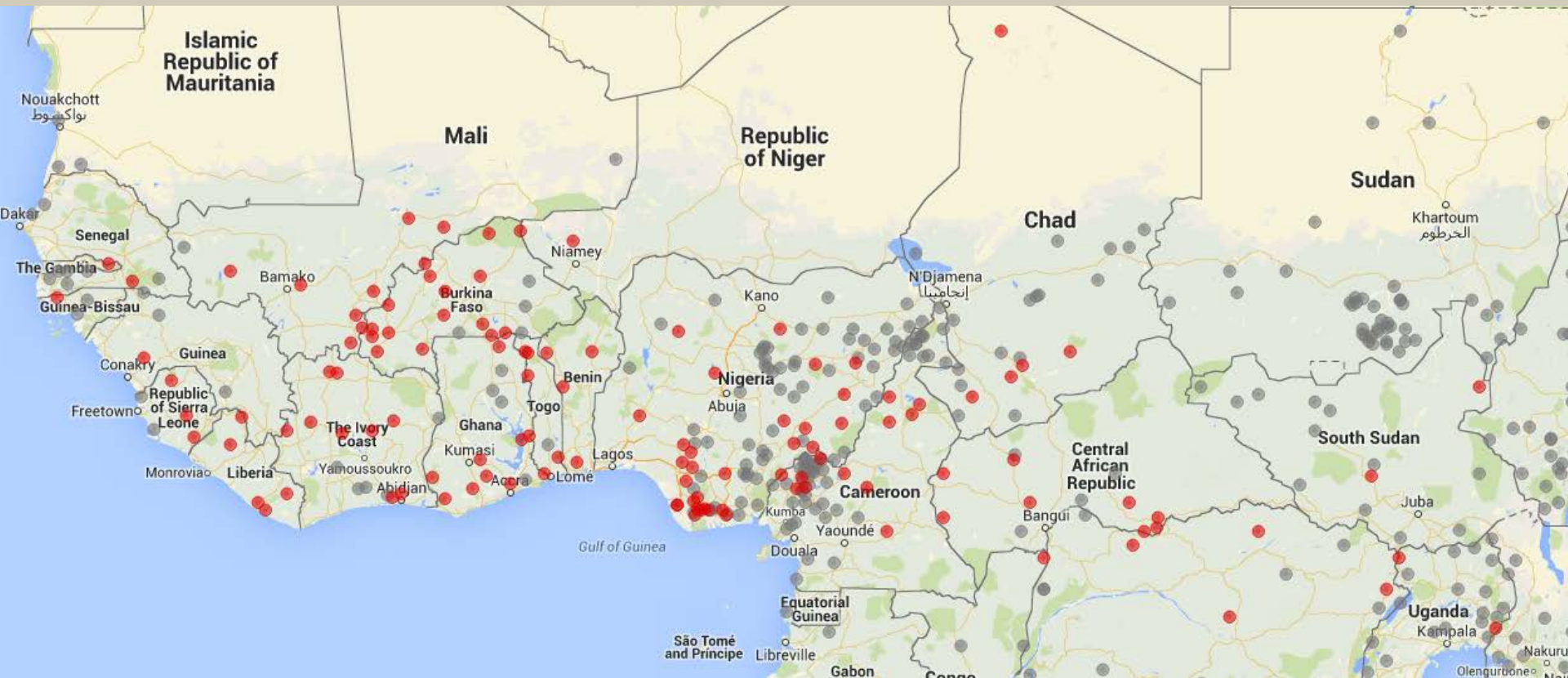
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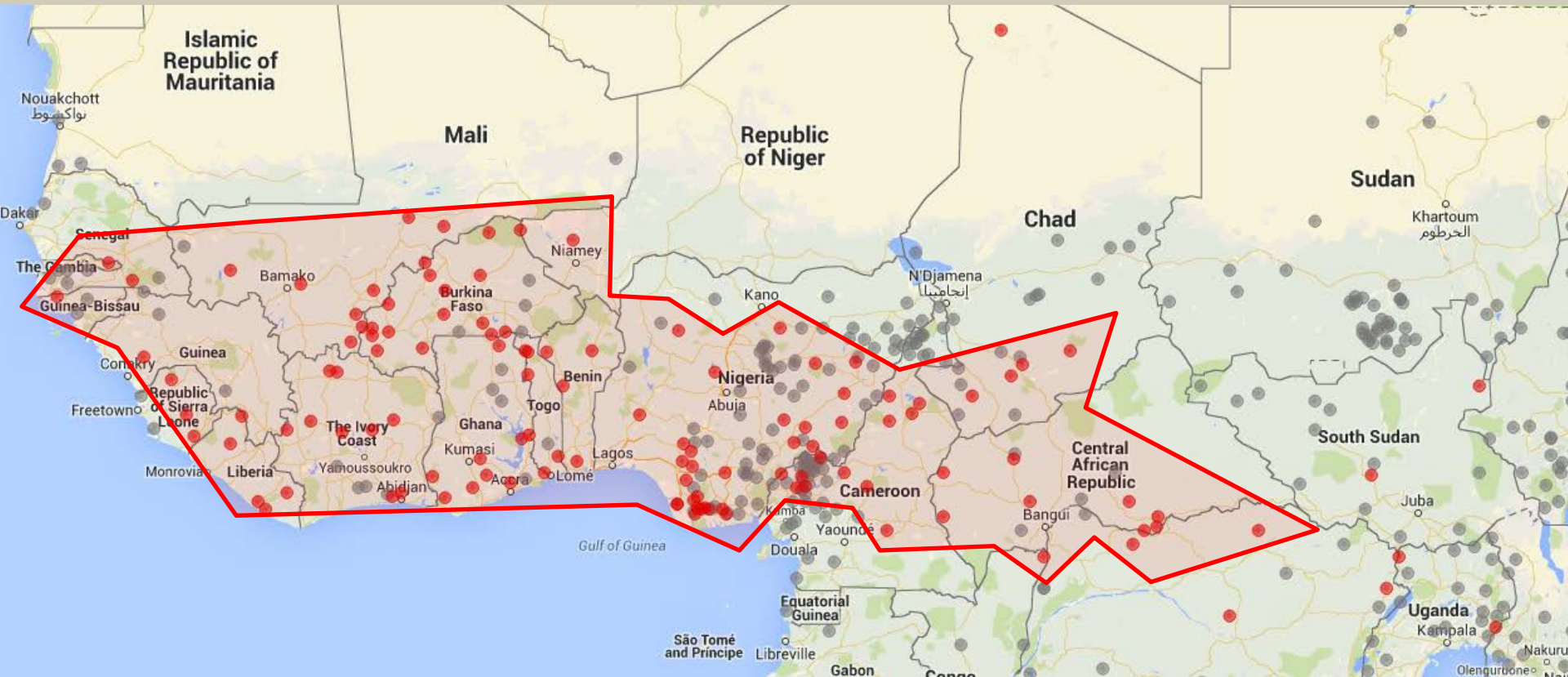
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World Phonotactics Database	3,776	723	19.1%
World Phonotactics - Africa	554	148	26.7%
World Phonotactics – Everywhere <i>but</i> Africa	3,220	575	17.9%

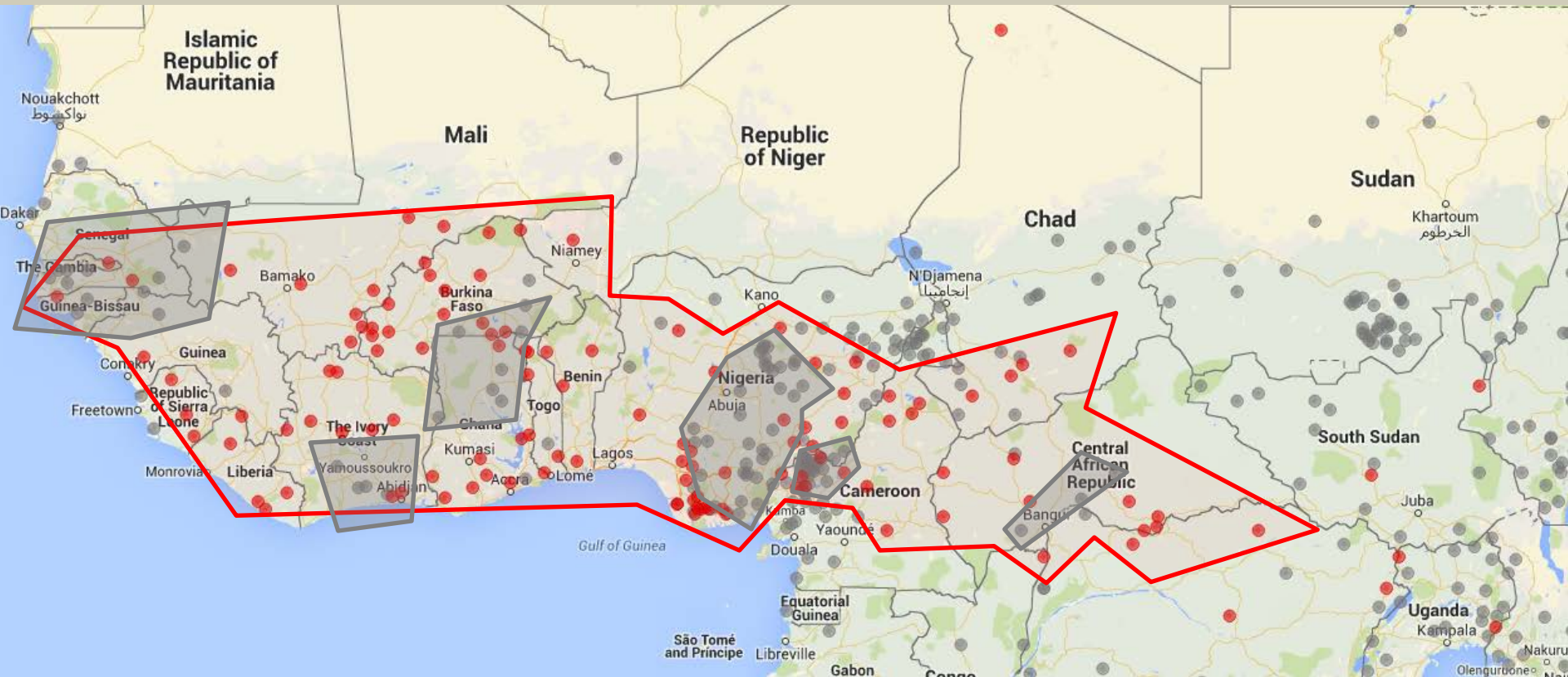
World Phonotactics Database



World Phonotactics Database



World Phonotactics Database



Family	N of languages	Nasal to Oral ratio	Types					Profile
			Oral	N – no */ẽ õ/ N - full set	N - full set	– restriction ẽ õ	Nasal – Other type	
Ijoid	8	7.00	1	0	3	3	1	Nasal
Mande	39	5.50	6	19	4	4	6	Nasal
Kwa	56	5.22	9	21	10	5	11	Nasal
Kru	22	1.75	8	6	3	0	5	Mixed
Gur/Senoufo	70	1.69	26	25	16	0	3	Mixed
Benue-Congo	101	1.02	50	25	14	3	9	Mixed
“Atlantic”	15	0.36	11	0	1	0	3	Oral
Other	24	0.33	18	5	1	0	0	Oral

Statistics – WAfr Nasal Vowel Systems

Front	O	N	#	%	Back	O	N	#	%	Low	O	N	#	%
i	i	ĩ	197	15.15	u	u	ũ	197	15.15	ə	ə	ẽ	16	1.60
210	i	*ĩ	13		210	u	*ũ	13		26	ə	*ẽ	10	
ɪ	ɪ	ĩ	46	2.56	ʊ	ʊ	ũ	46	2.71	a	a	ã	196	15.08
64	ɪ	*ĩ	18		63	ʊ	*ũ	17		209	a	*ã	13	
e	e	ẽ	98	0.89	o	o	õ	98	0.89					
208	e	*ẽ	110		208	o	*õ	110						
ɛ	ɛ	ẽ	162	6.75	ɔ	ɔ	õ	171	7.77					
186	ɛ	*ẽ	24		193	ɔ	*õ	22						

Statistics – WAfr Nasal Vowel Systems

Front	O	N	#	%	Back	O	N	#	%	Low	O	N	#	%
i	i	ĩ	197	15.15	u	u	ũ	197	15.15	ə	ə	ẽ	16	1.60
210	i	*ĩ	13		210	u	*ũ	13		26	ə	*ẽ	10	
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ɛ	ɛ	ẽ	162	6.75	ɔ	ɔ	õ	171	7.77					
186	ɛ	*ẽ	24		193	ɔ	*õ	22						

Statistics – WAfr Nasal Vowel Systems

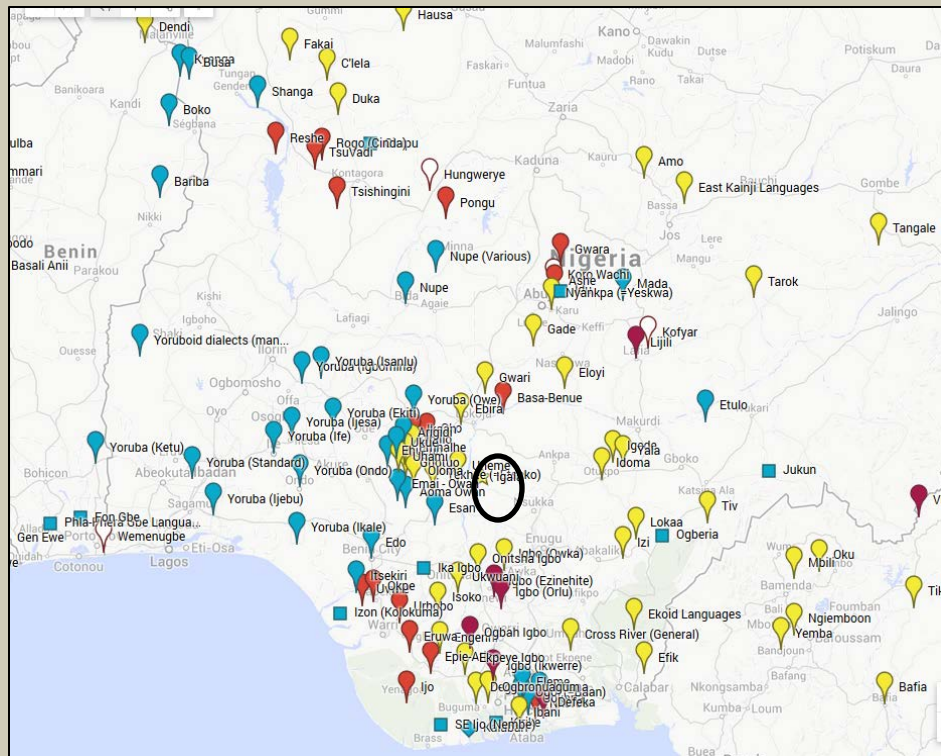
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i	i	ĩ	197	15.15	u	u	ũ	197	15.15	ə	ə	ẽ	16	1.60
210	i	*ĩ	13		210	u	*ũ	13		26	ə	*ẽ	10	
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208	e	*ẽ	110		208	o	*õ	110						
ɛ	ɛ	ẽ	162	6.75	ɔ	ɔ	õ	171	7.77					
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[illegible]

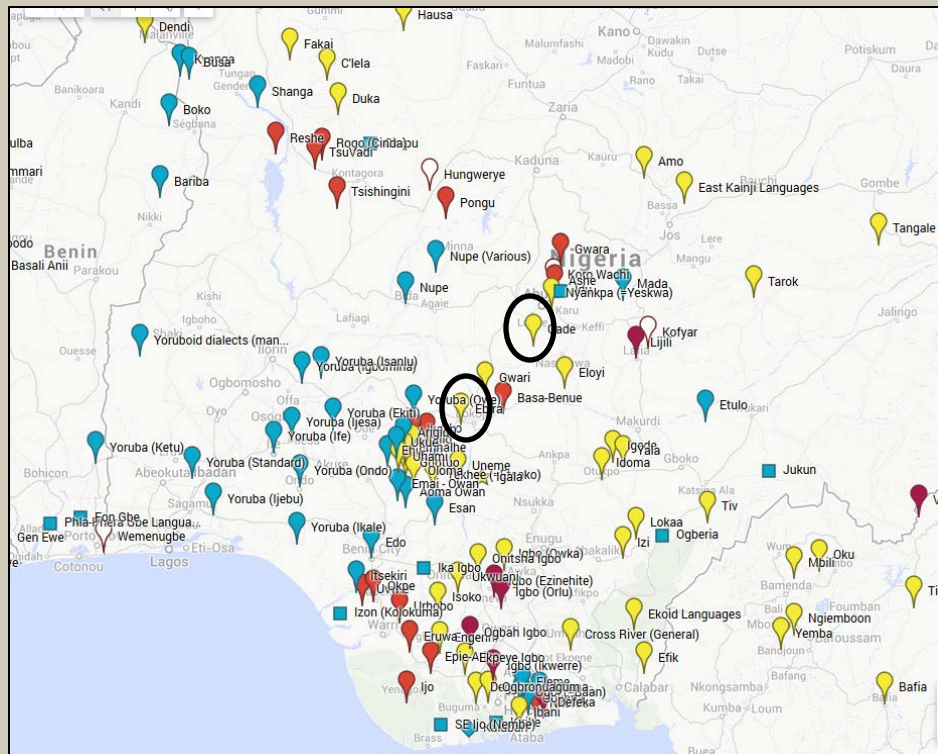
Areal pressures – Nigeria



Language	Igala	Ebira, Gade
Exhibits	Oral vowels	Oral vowels
Areal profile	Oral Vowel Zone 4	Oral Vowel Zone 4
Genetic Group	Yoruboid	Nupoid
Genetic profile	Nasal Vowels	Nasal vowels

Language	Ogoni langs.	Iboni
Exhibits	Nasal vowels	Oral vowels
Areal profile	Nasal Vowel Periphery	Igbo influence
Genetic Group	Cross River	Ijoid
Genetic profile	Oral vowels	Nasal vowels

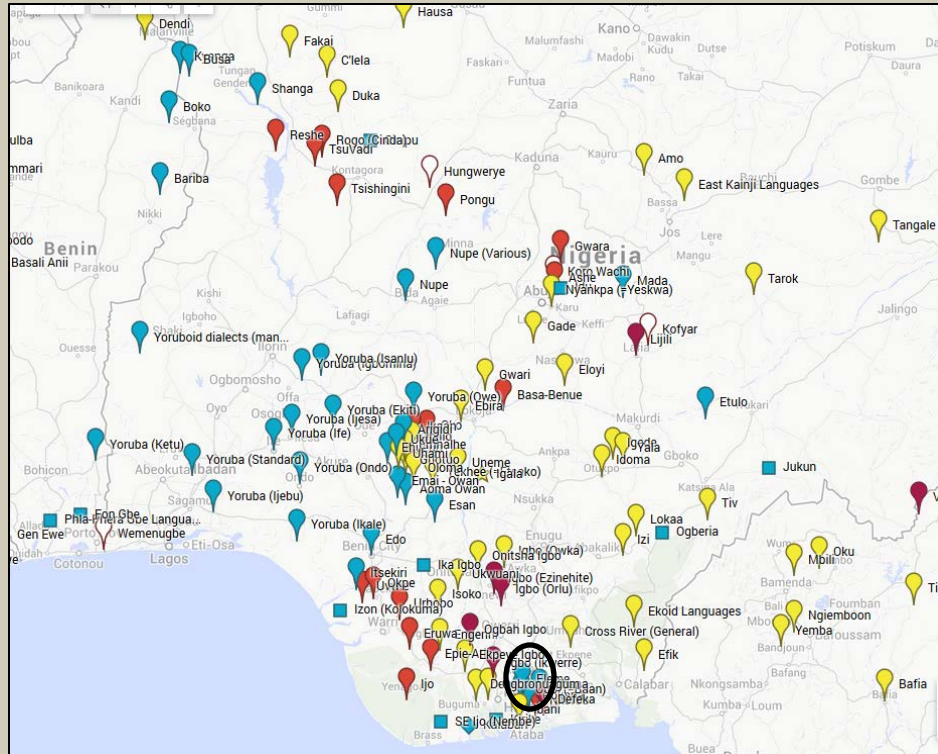
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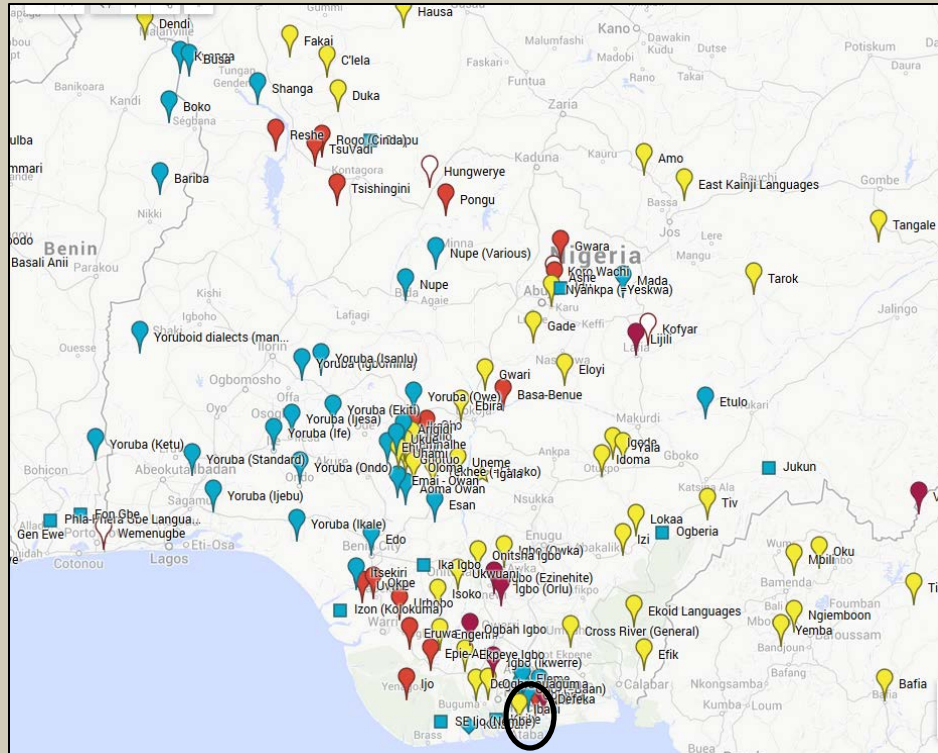
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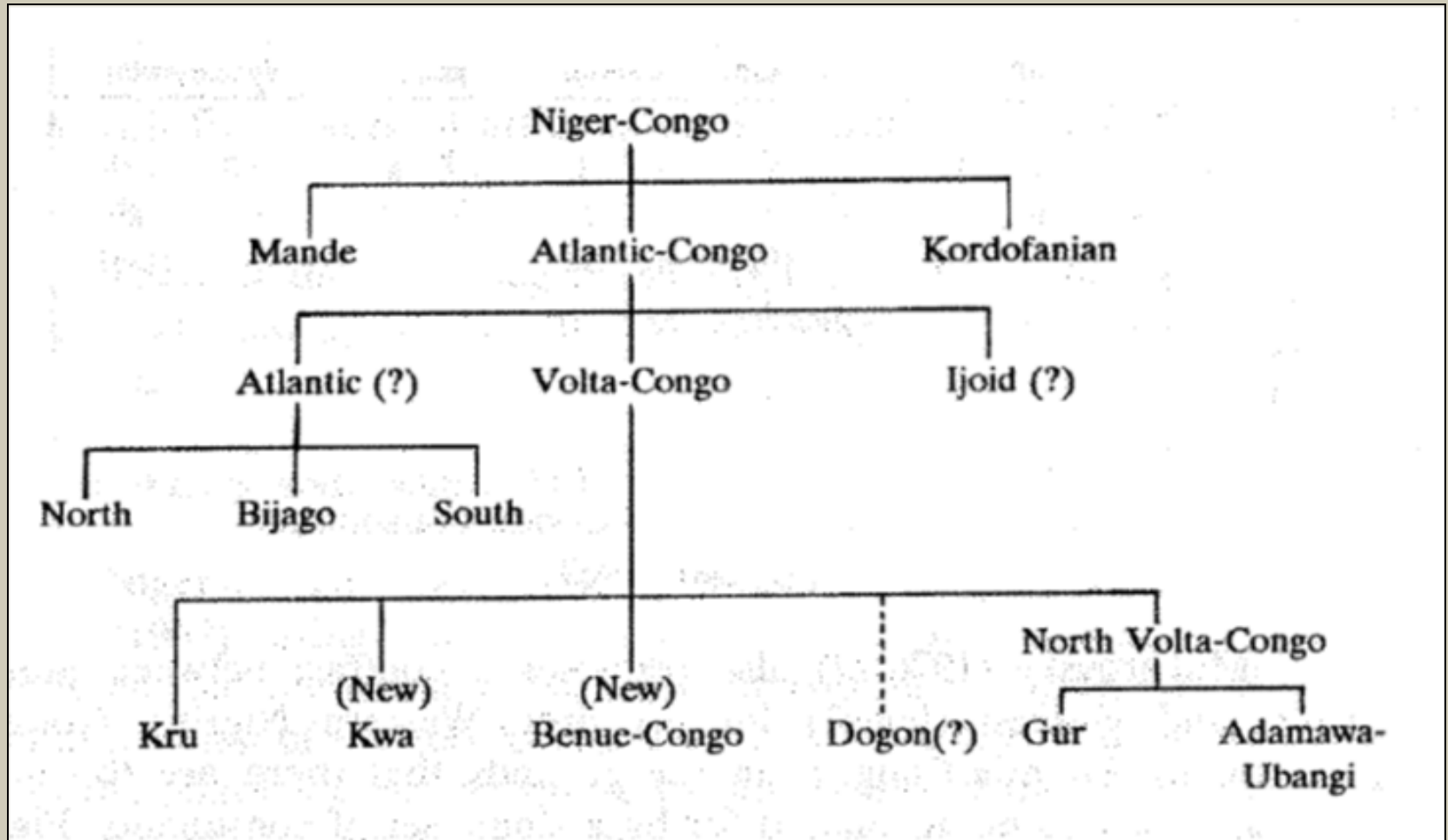
Language	Ogoni langs.	Iboni
Exhibits	Nasal vowels	Oral vowels
Areal profile	Nasal Vowel Periphery	Igbo influence
Genetic Group	Cross River	Ijoid
Genetic profile	Oral vowels	Nasal vowels

Areal pressures – Ghana (and North)

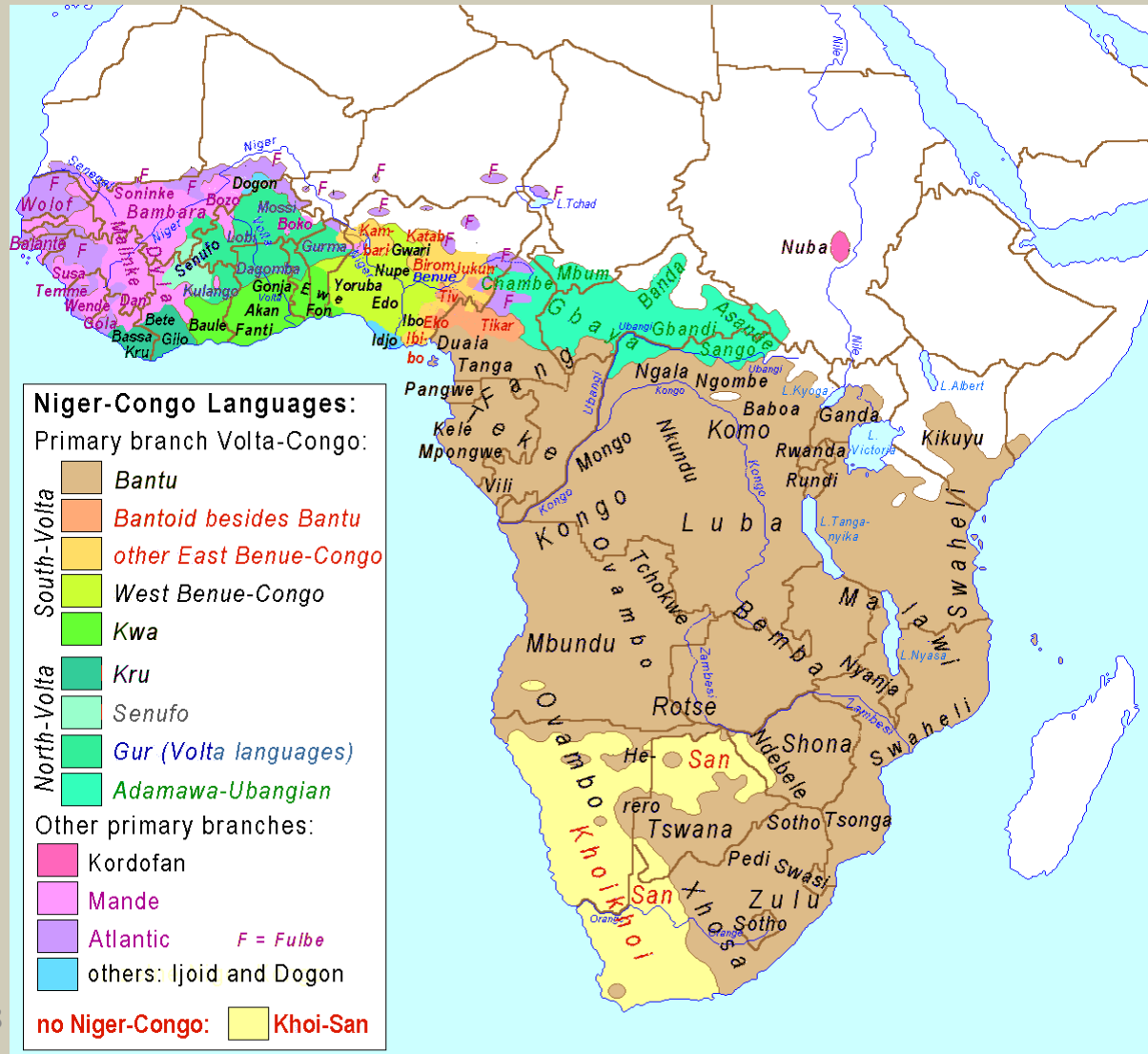
- Gur group – excellent case mixed oral/nasal genetic family
 - Naden (1989:154) - contrastive nasal vowels are “found a) in the southwest [Gur] languages, which may or may not be Gur, adjacent to Kwa, and b) in Gurma languages of the Ghana-Togo border”
 - Mieke (2013) –
 - Type A languages - contrastive nasal vowels
 - Type B languages - with non-contrastive, contextual nasalized vowels.
 - Striking geographical distribution
 - This split happens even across sub-groups, showing areal alignment over genetic preservation, e.g. in sub-groups Western Oti-Volta, Gurunsi North, and Gurunsi West

African Genetic Classification

Williamson (1989:21)



African Language Phyla – Niger-Congo Families



Explaining the Distribution

- Explanatory Goal - To which factors can we attribute these patterns?
 - **Genetic** – Vertical inheritance
 - **Areal** – Horizontal spread
 - **Universal Phonetic** – Independent developments
- “It is not clear to us whether nasal systems of this type have been inherited from a **common source**, whether they result from **diffusion**, or whether they have evolved **independently** in different languages.”
 - Clements & Rialland (2006:12), on nasal consonant phoneme-less systems in West Africa

Explaining the Distribution

- Keep in mind – Different areas within this vast Macro-Sudan Belt may have different origins
- Therefore, in one area genetic factors may be ultimately the cause, whereas in another, it may be due to universal phonetic factors
- What is known, however, is that gaps of /ẽ õ/ in these inventories is both (1) extremely common in the West African systems, and (2) has clear phonetic underpinnings due to inherent properties of nasal vowels

Ijo [Nigeria]

- Transition area between West African Nasal Vowel Macro-Zone and Lower Nigerian Oral Vowel Zone [5]
- **Proto-Ijo (Williamson 1989)**
- */i ɪ u ʊ e ε o ɔ ə a/ *ĩ ã ã ã ã ã ã ã
– only questionably */ẽ ẽ õ/ (Williamson 1989:397)
- In her reconstructed forms, *ẽ *õ are rare, and typically reconstructed as diphthongs *ẽ(ĩ) or *õ(ũ)
- However, *Proto-Ijo > the Inland Ijo variety Okordia (Okodia) –mid height distinction in nasal vowels
– /ídě́/ ‘thick, be(come) (of soup)’ (< *ĩdě́(í))
– vs. /ádẽ̃/ ‘four hundred’ (< *ĩdẽ̃)

Clements & Rialland 2006

