



DNA Tribes® Digest August 2, 2014

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## Introduction

Hello, and welcome to the August 2014 issue of DNA Tribes® Digest. This month's article examines local differences within Europe, focusing on the **Central European** and **Balto-Slavic** clusters. Notably, these ancestral components are expressed not only in East-Central Europe, but also in the Balkan Peninsula, Scandinavia, and the British Isles.

Results for these two closely interrelated genomic components (clusters) might reflect Europe's long history of maritime links via the Mediterranean Sea (the Central European cluster) and trans-continental links via the Eurasian Steppe (the Balto-Slavic cluster).

Best regards,  
Lucas Martin  
DNA Tribes

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## A Closer Look at Genetic Variation in East-Central Europe

### Background: Two Primary Clusters

The new DNA Tribes® SNP analysis features a detailed analysis of world genetic structure based on 44 clusters (groups of populations sharing ancestry), including the assessment of mixture of several ancestral components expressed in modern day Europeans.<sup>1</sup> Of several West Eurasian clusters, two identified in eastern parts of the European continent included (underlined in **Figure 1**):

- **Central European:** *Including West and South Slavic populations, but also characterizing Hungarians and (to some extent) German, Baltic, Western Ukrainian, and Southern Russian populations.*
- **Balto-Slavic:** *Including East Slavic and Baltic populations, as well as (to some extent) Uralic speaking populations of European Russia and West Slavic populations.*

To further explore relationships in eastern parts of Europe, this month's Digest article examines how these two clusters are expressed in European populations, as well as differences between the non-local components of each of these geographically overlapping genetic groups.



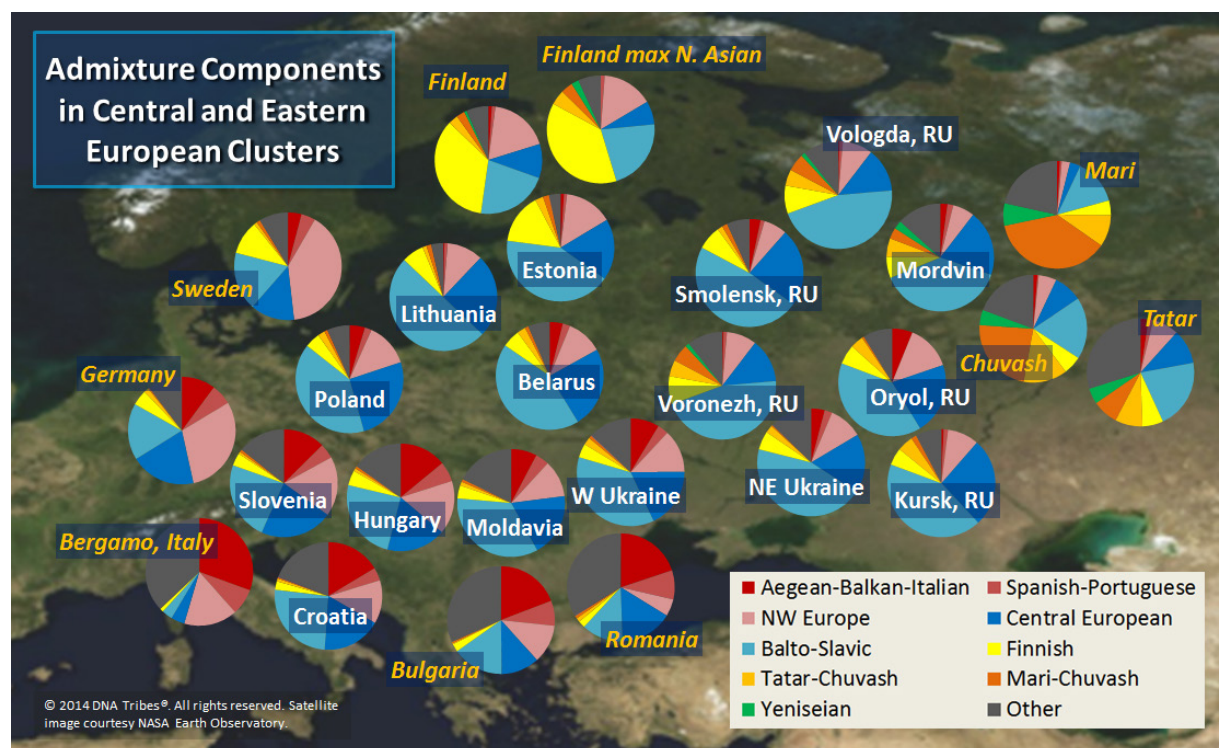
**Figure 1:** Map of major SNP components in Northwest European populations based on the 44 cluster analysis of world genetic structure included in the Summer 2014 DNA Tribes® SNP Update. For more information about the new SNP update, see <http://dnatribes.com/dnatribes-snp-update-june2014.pdf>.

<sup>1</sup> For more information about the new SNP update, see <http://dnatribes.com/dnatribes-snp-update-june2014.pdf>.

## SNP Components in Central and Eastern Europe

**Genetic Analysis:** Average percentages of 44 SNP components were identified for sampled populations in East-Central Europe, as well as several neighboring populations associated with other neighboring clusters. Results are listed in **Table 1** and illustrated in **Figure 2**.

**Discussion:** Results in **Table 1** and **Figure 2** express several genetic components that substantially vary between sampled Central and Eastern European populations.



**Figure 2:** Map of average percentages of SNP components expressed for genomes sampled from Central and Eastern European populations and neighboring countries.

The most variable component is **Balto-Slavic**, which reaches the highest percentage in sampled Lithuanians (50.0%), with other high percentages in: Smolensk, Russia (47.9%); Vologda, Russia (45.8%); and Northeast Ukraine (44.8%). The lowest percentages among sampled populations are in Slovenia (23.7%), Hungary (24.7%), and Croatia (25.7%). Notably, this component reaches the highest levels in Indo-European speaking populations to the east of the Baltic Sea, including areas where some scholars have suggested early **Eastern Baltic languages** were once spoken prior to Slavic expansions based on archaic Baltic hydronyms.<sup>2</sup>

<sup>2</sup> Other Baltic (Old Prussian) languages once spoken near the Vistula River were absorbed by Slavic and Germanic languages. However, further data would be needed to explore whether autosomal traces of these Western Baltic populations were retained in local German and Polish speaking populations historically living in Northern Poland.

It is worth noting that Baltic languages (namely, Lithuanian and Latvian) are some of the most archaic Indo-European languages still extant, retaining underived speech characteristics that were lost during subsequent expansions and cultural change in other less isolated parts of Europe. One possibility discussed in other Digest articles<sup>3</sup> is that the Balto-Slavic component in part relates to **Ancestral North Eurasian (ANE)** migrations (possibly originating near the Caspian Sea and Volga River) that spread early *satem* (Eastern) Indo-European languages in Europe and was later associated with **Baltic populations that were absorbed by expanding Slavic and Germanic speaking cultures**.<sup>4</sup>

In contrast, the second most variable component within East-Central Europe is not one of the primary clusters for these populations, but instead the **Aegean-Balkan-Italian** component. Among sampled East-Central Europeans, the highest percentages of this component are expressed in the **Balkan Peninsula** populations, including: Croatia (16.4%), Hungary (14.0%), and Slovenia (12.6%). The smallest Aegean percentages are expressed in: Lithuania (0.3%); Vologda, Russia (0.4%); and Kursk, Russia (0.7%).

This Balkan distribution of the Aegean component might reflect the periodic contacts between East-Central Europe and the Mediterranean world via the Danube River and Adriatic Sea. Outside of populations primarily associated with the Balto-Slavic and Central European clusters, higher Aegean percentages are expressed in Romania and Bulgaria, where this is the largest component (see **Table 1**).<sup>5</sup> These high Balkan percentages might include relatively recent Greco-Roman expansions during the Classical Period, as well as earlier contacts, including the **Bronze Age Mycenaean trade networks** linking the Aegean and Central Europe<sup>6</sup> and the more ancient **First Farmer expansions** that integrated cultures in the Balkan Peninsula, Aegean, and West Asia during the Neolithic period.<sup>7</sup>

The third most variable component within East-Central Europe is **Central European**. The largest average percentages of this component are expressed in sampled genomes from Voronezh, Russia (27.2%); Kursk, Russia (26.6%); Poland (25.8%); and Lithuania (25.0%). Notably, this distribution includes populations throughout East-Central Europe, with no clear geographical localization. For this reason, further analysis (including in the next section of this article) will be needed to examine this component in more detail.

In addition, percentages of several other components are expressed for the sampled East-Central European populations. These generally vary geographically, in relation to geographic proximity to the populations primarily associated with each cluster, such as Finland (**Finnish cluster**); Spain and Portugal; (**Spanish-Portuguese cluster**); and Britain and Scandinavia (**NW Europe cluster**).

Notably, the primary Siberian cluster expressed in Uralic and Indo-European (Slavic) speaking populations near the Baltic Sea is **Yeniseian**, expressed for Finland Max North Asian (the sub-group of sampled Finnish genomes with the highest North Asian percentages 2.2%) and Vologda, Russia (1.2%) populations (see **Table 1**). This suggests relationships between Paleo-Siberians and the Uralic periphery of Northern Europe (possibly in part dating to the Bronze Age **Seima-Turbino Phenomenon**).<sup>8</sup>

<sup>3</sup> For instance, see <http://dnatribes.com/dnatribes-digest-2014-06-02.pdf>.

<sup>4</sup> Discussion of recent ancient DNA evidence for westward expansions into ancient Europe such as the Unetice culture (possibly spreading *satem* Indo-European languages) is included at <http://dnatribes.com/dnatribes-digest-2013-12-03.pdf> and <http://dnatribes.com/dnatribes-digest-2013-11-01.pdf>.

<sup>5</sup> For full listings of all 44 world cluster components expressed in sampled European populations (including populations not listed in this article), see <http://dnatribes.com/dnatribes-snp-admixture-2014-06-03.pdf>.

<sup>6</sup> See <http://dnatribes.com/dnatribes-digest-2011-03-31.pdf>; <http://dnatribes.com/dnatribes-digest-2011-11-01.pdf>.

<sup>7</sup> For more discussion, see <http://dnatribes.com/dnatribes-digest-2013-11-01.pdf>.

<sup>8</sup> Discussed in this article: <http://dnatribes.com/dnatribes-digest-2013-06-01.pdf>.

Population	Aegean-Balkan-Italian	Spanish-Portuguese	NW Europe	Central European	Balto-Slavic	Finnish	Tatar-Chuvash	Mari-Chuvash	Yeniseian	Other
Belarus	3.9%	2.2%	10.8%	24.2%	43.3%	5.3%	2.6%	1.1%	0.0%	6.5%
<i>Bergamo Italy</i>	<b>30.6%</b>	7.9%	16.1%	4.1%	3.2%	1.1%	0.0%	0.1%	0.0%	37.0%
<i>Bulgaria</i>	19.2%	7.5%	11.6%	11.5%	15.4%	2.4%	0.3%	0.4%	0.0%	31.6%
<i>Chuvash Russian Federation</i>	1.3%	0.4%	5.4%	8.6%	18.6%	5.5%	<b>13.2%</b>	23.2%	4.6%	19.4%
Croatia	16.4%	3.9%	13.1%	17.8%	25.7%	2.6%	0.9%	0.4%	0.2%	19.1%
Estonia	1.0%	0.9%	14.5%	18.4%	42.2%	15.2%	2.4%	1.9%	0.1%	3.4%
<i>Finland</i>	1.0%	1.1%	18.1%	10.2%	21.8%	34.9%	2.9%	2.5%	0.8%	6.7%
<i>Finland Max North Asian</i>	0.0%	1.2%	15.3%	7.0%	21.8%	<b>37.6%</b>	4.5%	3.6%	2.2%	6.8%
<i>Germany</i>	10.2%	6.2%	30.1%	19.7%	17.0%	4.6%	1.5%	0.3%	0.0%	10.4%
Hungary	14.0%	6.0%	16.1%	17.8%	24.7%	4.5%	0.9%	0.8%	0.0%	15.2%
Kursk Russia	0.7%	1.3%	9.4%	26.6%	42.6%	5.2%	4.8%	1.6%	0.0%	7.7%
Lithuania	0.3%	1.0%	10.8%	25.0%	<b>50.0%</b>	6.6%	1.2%	1.4%	0.1%	3.6%
<i>Mari Russian Federation</i>	0.8%	0.6%	2.5%	3.2%	13.6%	4.4%	9.6%	<b>37.0%</b>	<b>6.8%</b>	21.5%
Moldavia	7.8%	4.1%	11.1%	19.0%	34.4%	3.9%	1.2%	0.8%	0.0%	17.7%
Mordvin	2.2%	1.8%	6.5%	19.7%	38.6%	6.4%	5.6%	3.3%	2.5%	13.3%
Oryol Russia	6.2%	0.0%	13.6%	21.5%	39.4%	5.9%	4.0%	0.6%	0.0%	8.8%
Poland	4.7%	2.0%	13.2%	25.8%	39.9%	4.6%	2.1%	1.0%	0.0%	6.7%
<i>Romania</i>	19.9%	<b>8.7%</b>	5.1%	15.7%	12.5%	2.1%	1.2%	0.9%	0.1%	33.8%
Slovenia	12.6%	4.5%	17.9%	21.8%	23.7%	3.8%	0.7%	0.8%	0.0%	14.3%
Smolensk Russia	3.3%	1.2%	7.0%	23.4%	47.9%	7.2%	1.6%	1.6%	0.0%	6.9%
<i>Sweden</i>	4.1%	4.3%	<b>39.9%</b>	13.3%	17.6%	10.2%	0.9%	1.1%	0.1%	8.7%
<i>Tatar Russian Federation</i>	2.5%	1.4%	7.9%	10.4%	21.0%	6.3%	8.2%	7.7%	4.7%	29.9%
Ukraine Northeast	4.1%	2.3%	10.1%	17.7%	44.8%	5.6%	2.3%	0.4%	0.0%	12.8%
Ukraine Western	8.7%	3.3%	12.9%	18.1%	36.5%	4.2%	2.3%	0.9%	0.2%	12.9%
Vologda Northern Russia	0.4%	1.0%	9.1%	13.2%	45.8%	8.4%	4.9%	5.3%	1.2%	10.7%
Voronezh Russia	5.4%	6.0%	9.7%	<b>27.2%</b>	36.7%	1.8%	4.6%	3.2%	0.4%	4.9%

**Table 1:** Average percentages of several SNP components in sampled populations in Central and Eastern Europe, as well as several neighboring populations associated with other clusters (*italics*). The population for which the largest percentage of each SNP component is highlighted in yellow.

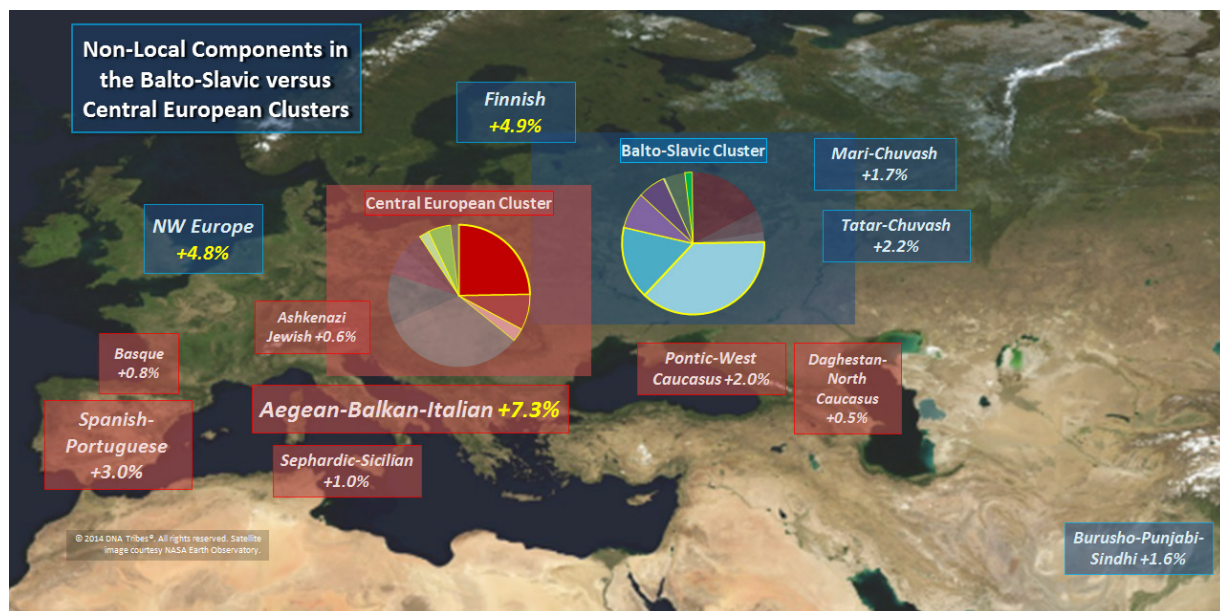
## Differences between the Central European and Balto-Slavic Clusters

**Genetic Analysis:** To further explore the distinction between the Central European and Balto-Slavic genetic clusters, this section examines non-local components of these two clusters (excluding local Central European and Balto-Slavic components). Results are presented in **Table 2** and **Figure 3**.

**Discussion:** Results in **Table 2** and **Figure 3** express similar components in both clusters, with slight but geographically consistent differences in the non-local components expressed within each cluster.

The components for which larger percentages were expressed for the **Central European** cluster (highlighted in **red** in **Table 2**) include: Aegean-Balkan-Italian (+7.3%); Spanish-Portuguese (+3.0%); Pontic-West Caucasus (+2.0%); Sephardic-Sicilian (+1.0%); Basque (+0.8%); Ashkenazi Jewish (+0.6%); and Daghestan-North Caucasus (+0.5%). Notably, all of these components are associated with **Mediterranean and West Asian** populations.

**This suggests that the Central European cluster has been shaped to a larger extent by southeastern contacts, possibly via the Balkan Peninsula.** In particular, these might include expansions and trade contacts with the Classical Etruscan and Greco-Roman civilizations, as well as more ancient Mycenaean trade networks integrating Bronze Age societies of Central Europe, the Aegean, and West Asia (discussed earlier in this article).



**Figure 3:** Map highlighting differences in non-local components in the **Balto-Slavic** (highlighted in blue) and **Central European** (highlighted in red) clusters.

In contrast, the components for which larger percentages were instead expressed for the **Balto-Slavic** cluster (highlighted in **blue** in **Table 2**) include: Finnish (+4.9%); NW Europe (+4.8%); Tatar-Chuvash (+2.2%); Mari-Chuvash (+1.7%); and Burusho-Punjabi-Sindhi (+1.6%). These include clusters associated with **Northern Europe, Siberia, and Central-South Asia**. This might reflect traces of an **earlier layer of Ancestral North Eurasian (ANE) expansions linking Europe with Siberia and Central Asia**.

If so, this Balto-Slavic genetic stratum in Europe might be related to **Bronze Age “Kurgan” expansions from the Eurasian Steppe, pushed outwards to Northern Europe** by populations linked to Mediterranean and West Asian civilization centers (such as Iron Age Hallstatt and Greco-Roman related expansions). Notably, these components today are associated with several languages (such as Indo-European, Uralic, and Turkic). This suggests that the Kurgan migrations (like later steppe confederations of the Iron Age) involved **multiple language groups sharing elements of material culture and similar lifeways** rather than a single ethno-linguistic origin.

Cluster	Balto-Slavic	Central Europe	Difference
Aegean-Balkan-Italian	17.4%	24.7%	7.3%
Spanish-Portuguese	5.1%	8.1%	3.0%
Pontic-West Caucasus	0.4%	2.3%	2.0%
Sephardic-Sicilian	0.0%	1.0%	1.0%
Basque	2.3%	3.0%	0.8%
Ashkenazi Jewish	0.3%	0.9%	0.6%
Daghestan-North Caucasus	4.6%	5.1%	0.5%
Burusho-Punjab-Sindhi	1.6%	0.0%	1.6%
Mari-Chuvash	6.2%	4.5%	1.7%
Tatar-Chuvash	8.3%	6.1%	2.2%
NW Europe	37.3%	32.5%	4.8%
Finnish	16.6%	11.7%	4.9%

**Table 2:** Differences in non-local components in the **Balto-Slavic** and **Central European** clusters.

## Conclusion

Results presented in this article indicate that the Central European and Balto-Slavic clusters, although geographically closely related and expressed throughout Northern Europe, might reflect two somewhat different population strata: (1) A Mediterranean and West Asian layer reflected in Central European components; and (2) A Northern European and Eurasian layer reflected in Balto-Slavic components. These two closely interrelated strata might reflect a long history of maritime links via the Mediterranean Sea (Central European) and continental links via the Eurasian Steppe (Balto-Slavic).

## DNA Tribes® SNP Update for Summer 2014

We are pleased to announce a new update for DNA Tribes® SNP analysis. This includes:

- New Populations
- Updated Admixture Analysis
- Updated MDS Analysis
- Enhanced Population Admixture (*Best Fits for Your Genome Composition*)
- New Population Admixture (*Alternative Iterative Fits for Your Genome Composition*)
- Enhanced World Region Grid (*Best Fits for Your Genome Composition*)
- Enhanced Population Similarity (*Best Fits for Your Genome Composition*)
- Updated Admixture Tables

### **New** Caucasus Mountains Populations:

- Azerbaijan
- Imer Georgia
- Kabardin
- Laz Georgia
- Tabasaran

### **New** Diasporic Populations:

- Jewish Algeria
- Jewish France
- Jewish Italy
- Jewish Kurdistan
- Jewish Libya
- Jewish Syria
- Jewish Tunisia

### **New** European Populations:

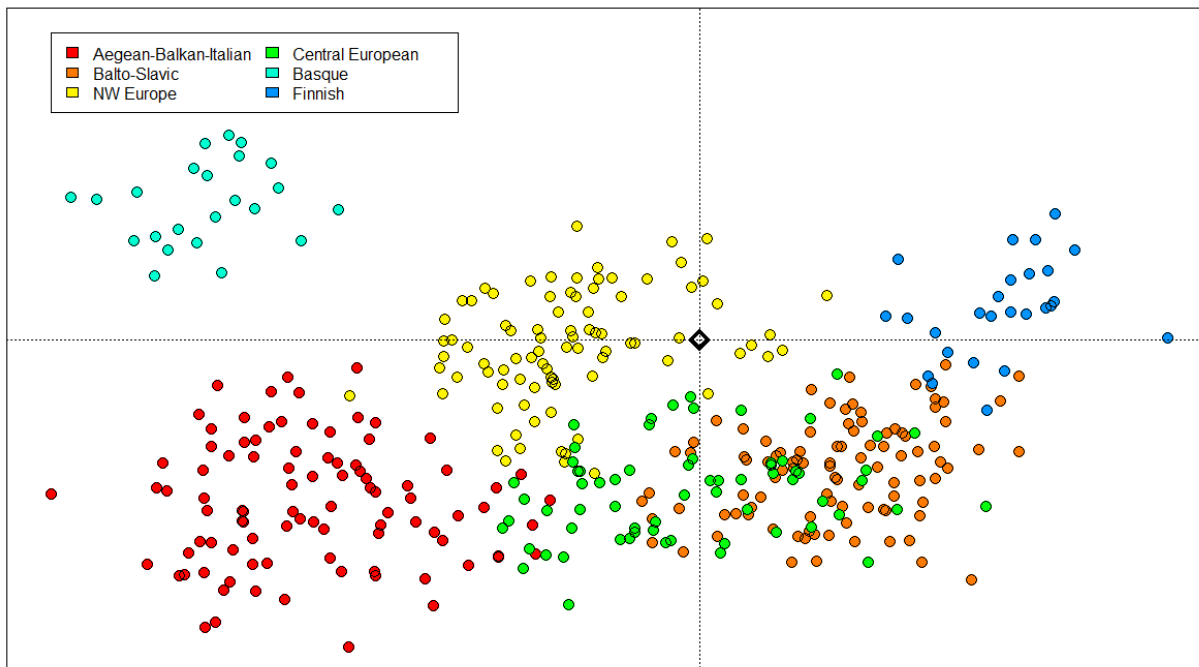
- Abruzzo, Italy
- Agrigento, Sicily
- Central Greece
- Central Sicily
- Croatia
- Kursk, Russia
- Moldavia
- Oryol, Russia
- Smolensk, Russia
- Sweden (*new samples*)
- Tatar Russian Federation
- Thessaly, Greece
- Voronezh, Russia
- Western Sicily

**Updated** Admixture Analysis based on DNA Tribes® proprietary analysis of world population structure, based on **five continental cores** and **44 detailed regional clusters**:

Continental Core	Percentage
Basque	75.3%
Dravidian South India	17.5%
Mesoamerican	6.6%
Aka-Mbuti-Hadza	0.6%
South China	0.0%

Regional Cluster	Percentage
NW Europe	44.2%
Balto-Slavic	29.8%
Central European	10.4%
Finnish	7.3%
Basque	5.7%
Aegean-Balkan-Italian	2.8%

**Updated Multi-Dimensional Scaling (MDS)** to visualize your genotype's position among continent cores and genetic clusters:

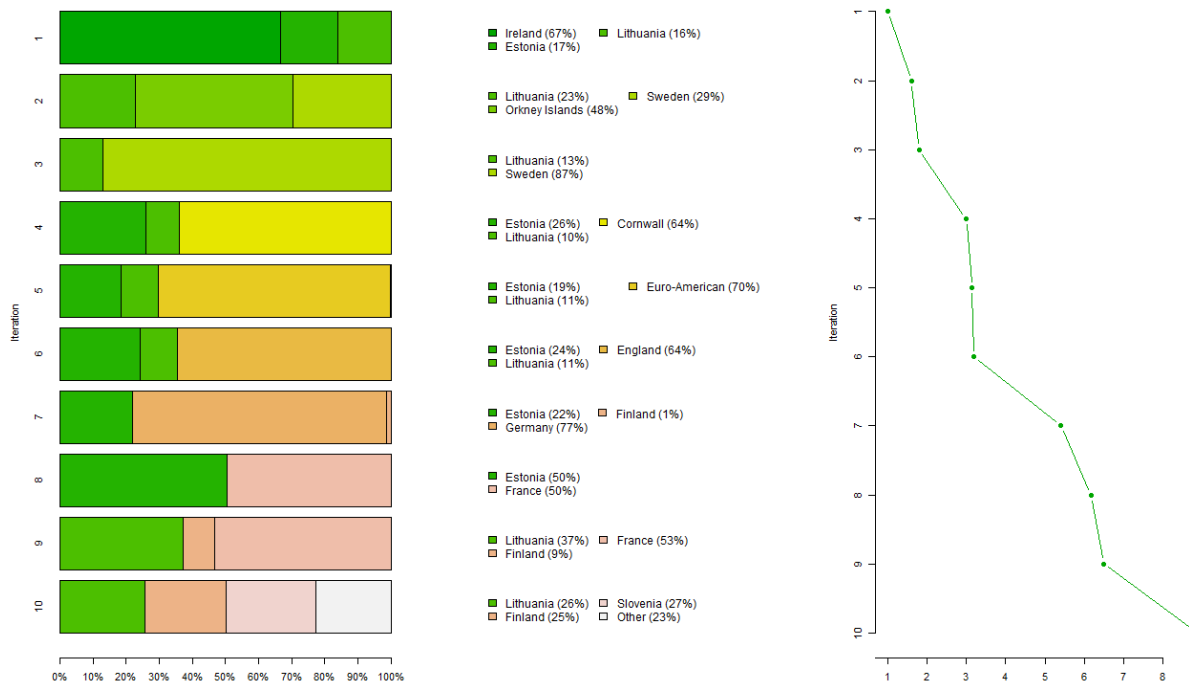


**Enhanced Population Admixture (Best Fit for Your Genome Composition)** based on the combination of populations that best fits your genome's ancestral composition:

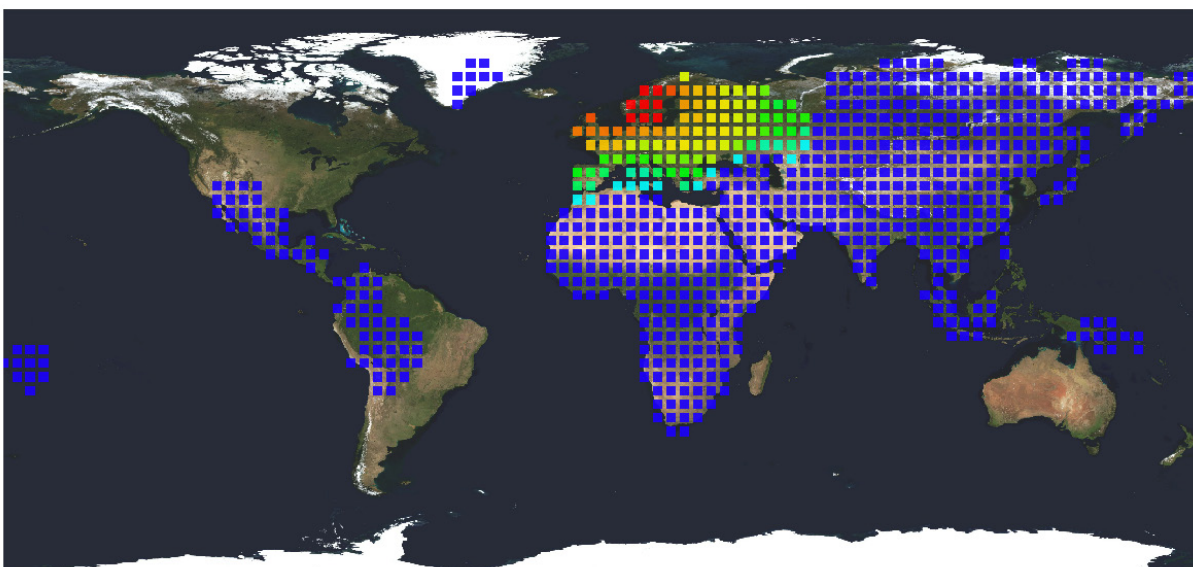
Population (Native Only)	Percentage
Ireland	66.5%
Estonia	17.5%
Lithuania	16.0%

Population (Native and Global)	Percentage
Ireland	66.5%
Estonia	17.5%
Lithuania	16.0%

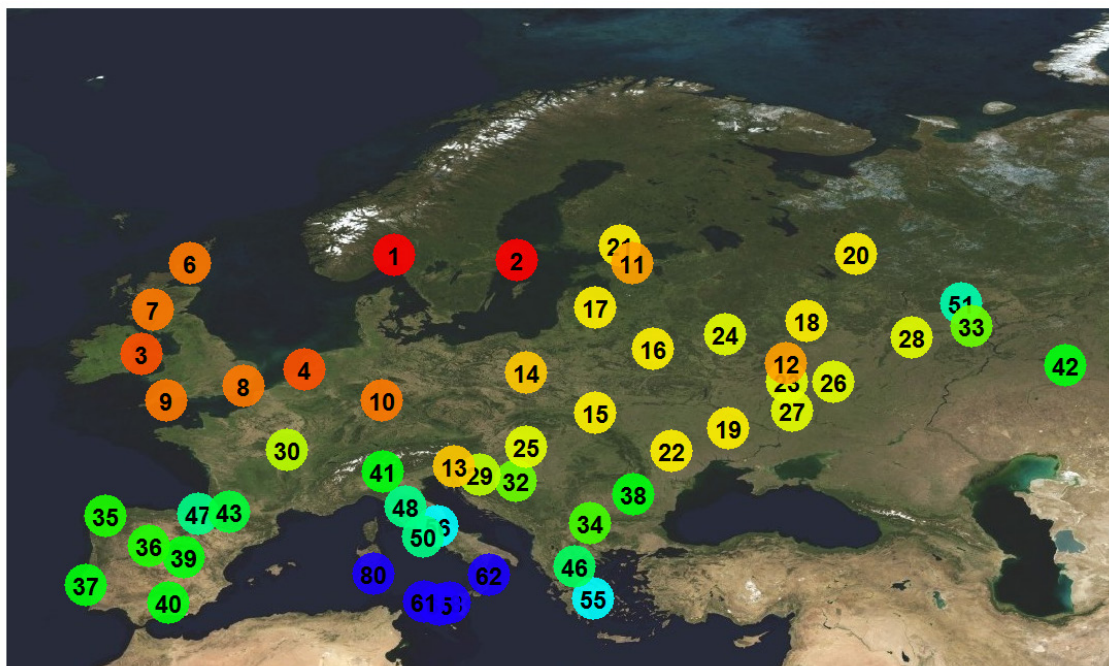
**Enhanced Population Admixture (Alternative Iterative Fits)** illustrating several alternative combinations of populations that fit your genome's ancestral composition:



**Enhanced World Grid Genome Fit Map** showing the geographical distribution of your combination of 44 ancestral components on a shaded world map:



**Enhanced Population Genome Fit Rankings** individually listing the countries and ethnic groups in our SNP database where your combination of 44 ancestral components fits best:



**Updated World Admixture Tables** (including average **five continent core** and **44 region cluster** percentages for samples populations in our SNP database) are available at <http://dnatribes.com/dnatribes-snp-admixture-2014-06-03.pdf>.

**Update Your Personal SNP Analysis** New SNP analysis orders (**Sale Price \$39.99** with submitted grandparent information form) and SNP updates (**\$19.99**) be ordered at <http://dnatribes.com/snp.html>.