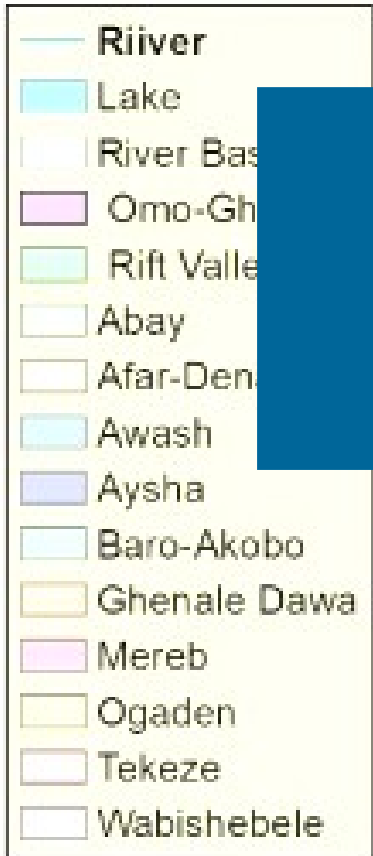


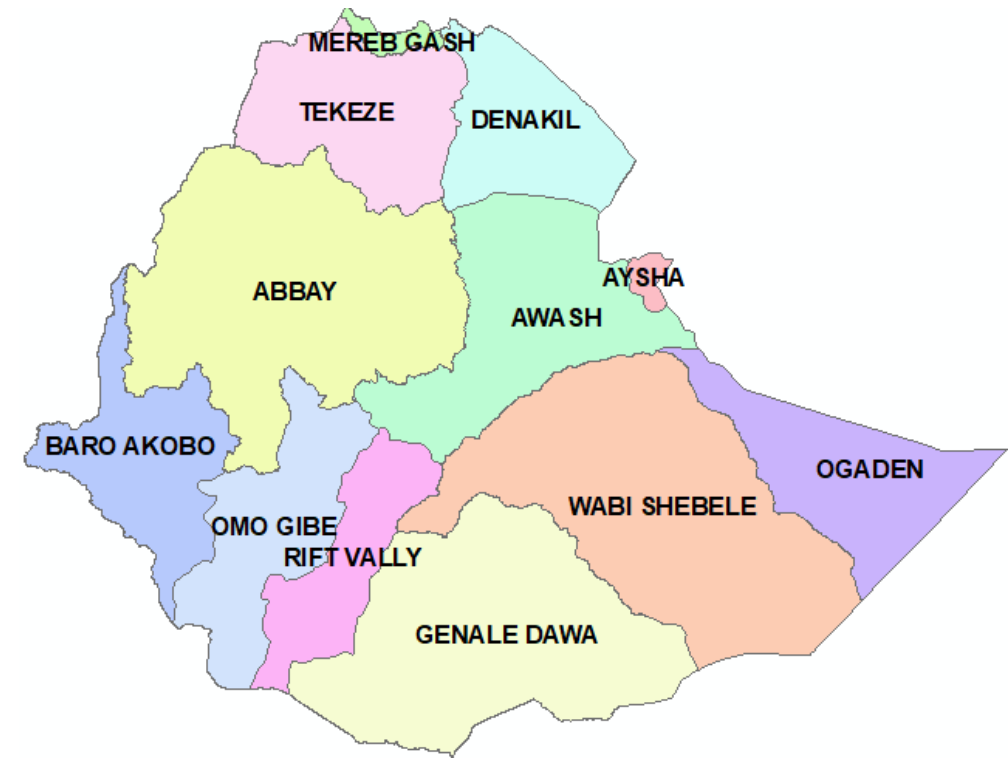
Chapter Four

Drainage systems and Water Resource of Ethiopia and the Horn



Introduction

- About **71%** of the earth's surface is covered by water bodies majorly occupied by seas and oceans.
- Of the Earth's total water surface,
 - Nearly **97.5%** is alkaline accumulated in seas and oceans.
 - The remaining **2.5%** is fresh water,
 - 68.7% is deposited in glaciers,
 - 30.1% in ground water,
 - 0.8% in permafrost and
 - 0.4% in surface waters



Introduction

- In Ethiopia
 - The diverse topographical setup
 - relatively higher rainfall and
 - its nearness to equator made the country to have larger volume of ground and surface water.
- Around **0.7 %** of the total land mass of Ethiopia is covered by water bodies.
- The country's surface water potential as studied in different integrated river basin master plans is estimated to be 124.4 billion cubic meters (BCM).
- Consequently, many call Ethiopia, **the water tower of “Eastern Africa”**.

Activity

Form a group of three to four students and
Define the following terms

- Drainage
- Drainage system
- Drainage pattern
- Catchment area/ basin
- Watershed

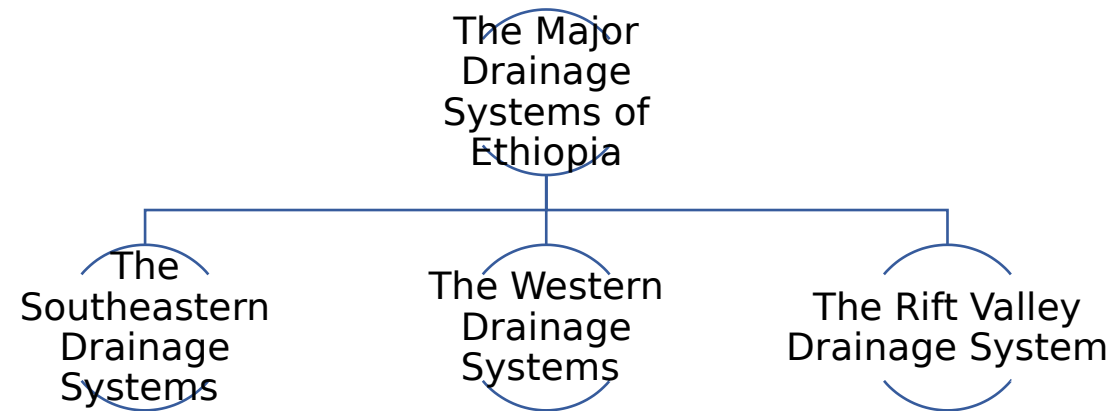
Answer for the Activity

- **Drainage**
 - is flow of water through well-defined channel.
- **Drainage system**
 - is branched network of stream channels together with the adjacent land slopes they drain.
- **Drainage basin (Catchment area)**
 - is the topographic region from which a river and its tributaries collect both the surface runoff and subsurface flow.
- **Drainage pattern:**
 - is the arrangement and shapes of rivers with their tributaries
- **Watershed**
 - is the highland that separates two basins.

Drainage System of Ethiopia

The general patterns of major river basins in Ethiopia are determined by

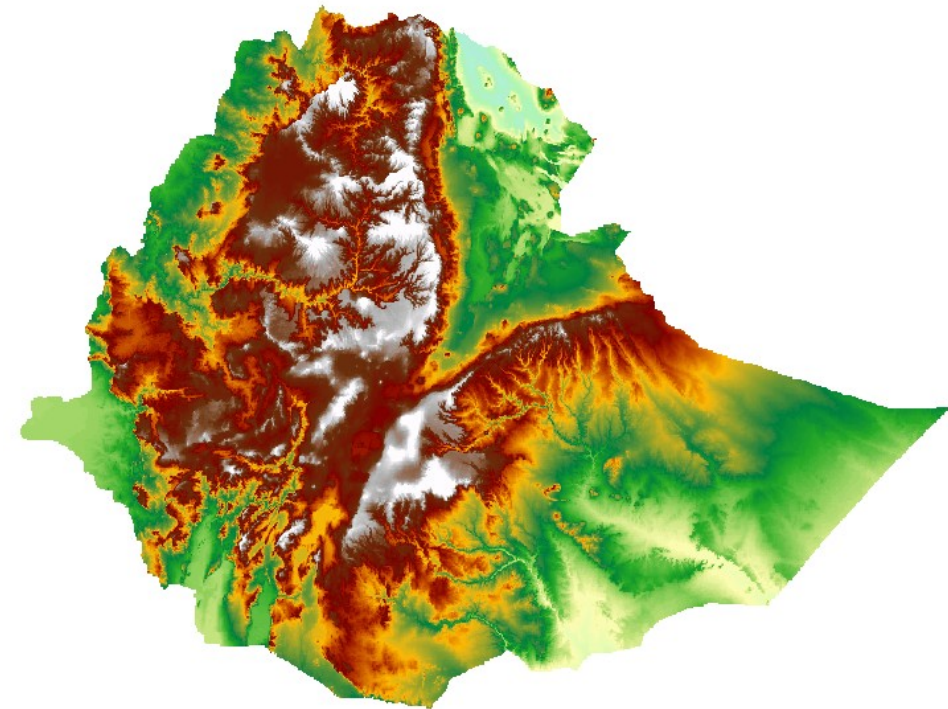
- The topography of the outward sloping of the Western and South eastern plateaus
- The structural formation of the Rift Valley with its in-ward-sloping escarpments resulting mainly in an inland drainage system.
- Faults and joints that structurally influence part of the courses of many rivers.

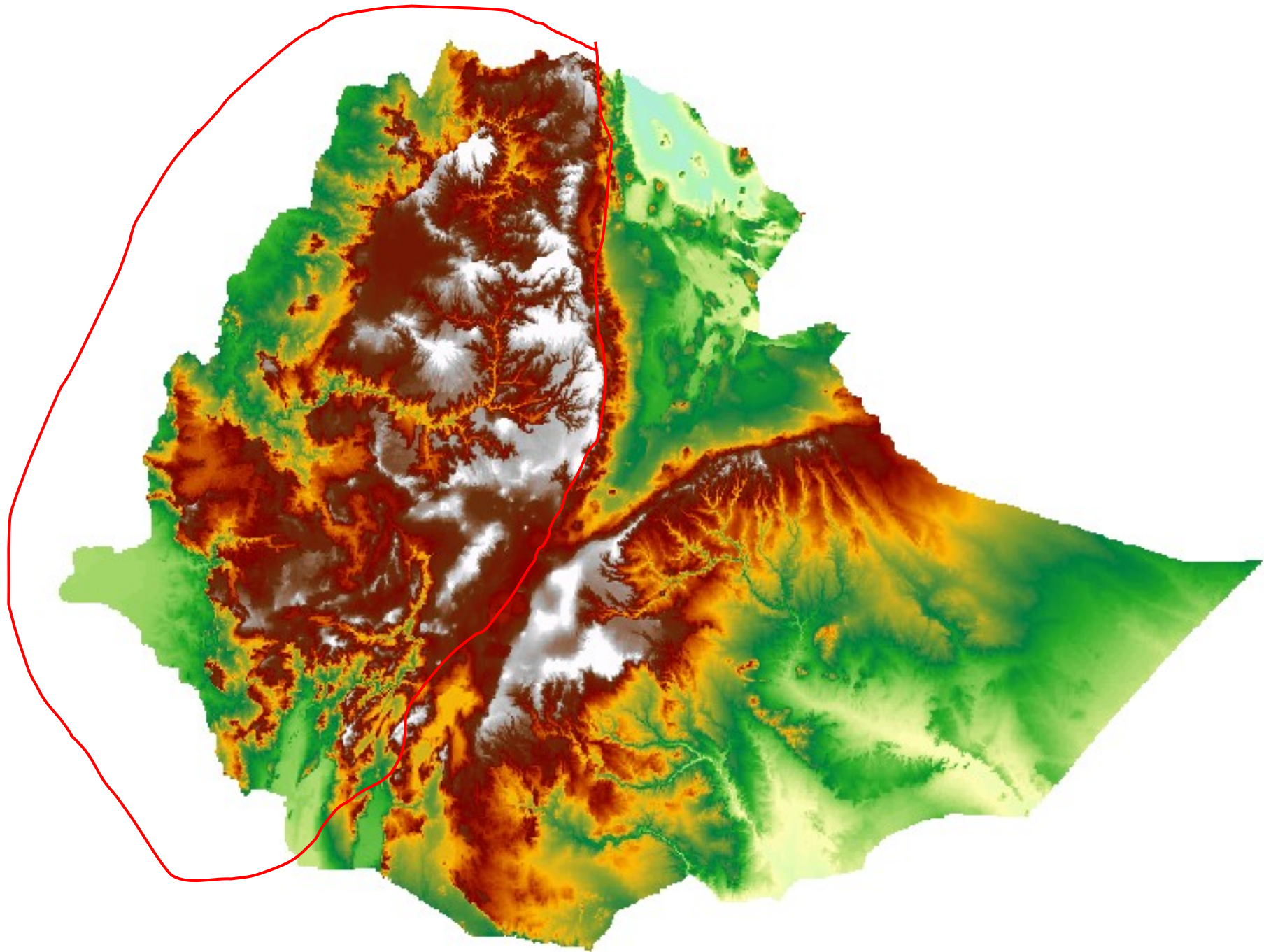


Drainage System of Ethiopia

Western Drainage System

- The Western Drainage Systems are the largest of all drainage systems draining 40 percent of the total area of the country and carry 60 percent of the annual water flow.
- This drainage system comprises four major river basins:
 - Tekeze (major tributers are (Angereb and Goang) (12%),
 - Abay (65%), Baro-Akobo (17%), Ghibe (Omo) (6%).
 - Omo /Ghibe/ - flows to south (exceptional)
- Tekeze, Abay, Baro-Akobo= Join the Nile and finally to Mediterranean Sea
- The name of some rivers be changed after crossing international boundary.

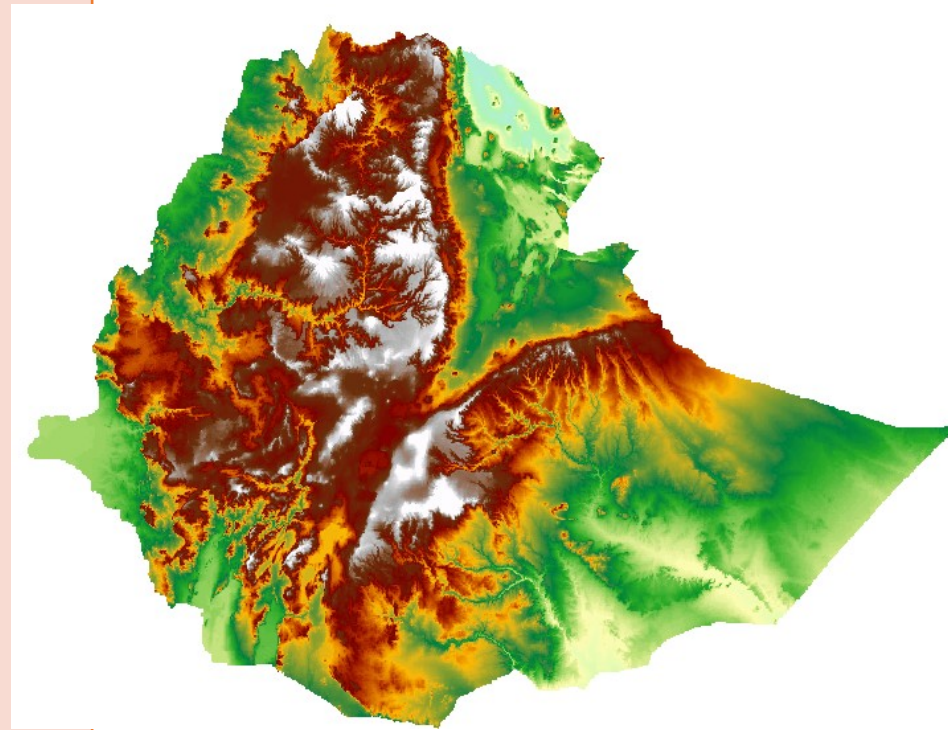


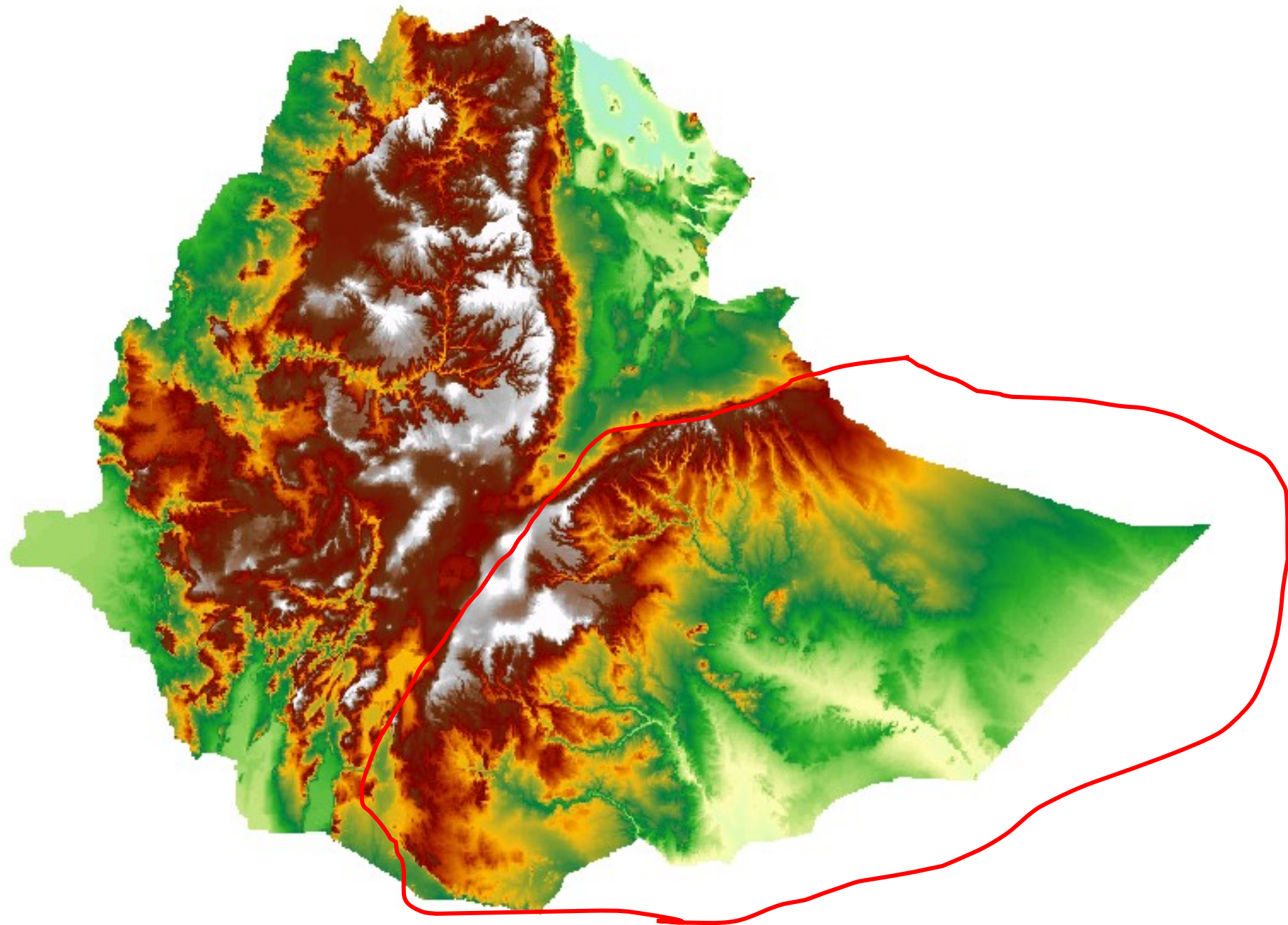


Drainage System of Ethiopia

The Southeastern Drainage Systems

- The basin which is mainly drained by Wabi-shebelle and Ghenale, slopes south-eastwards across large water deficient plains.
- Major highlands of this basin include plateaus of **Arsi, Bale, Sidama and Harerghe**.
- Wabshebelle and Ghenale rivers cross the border into Somalia, carrying **25** percent of the annual water flow of Ethiopia.
- Ghenalle has fewer tributaries but carries more water than Wabi-shebelle, reaches the Indian Ocean

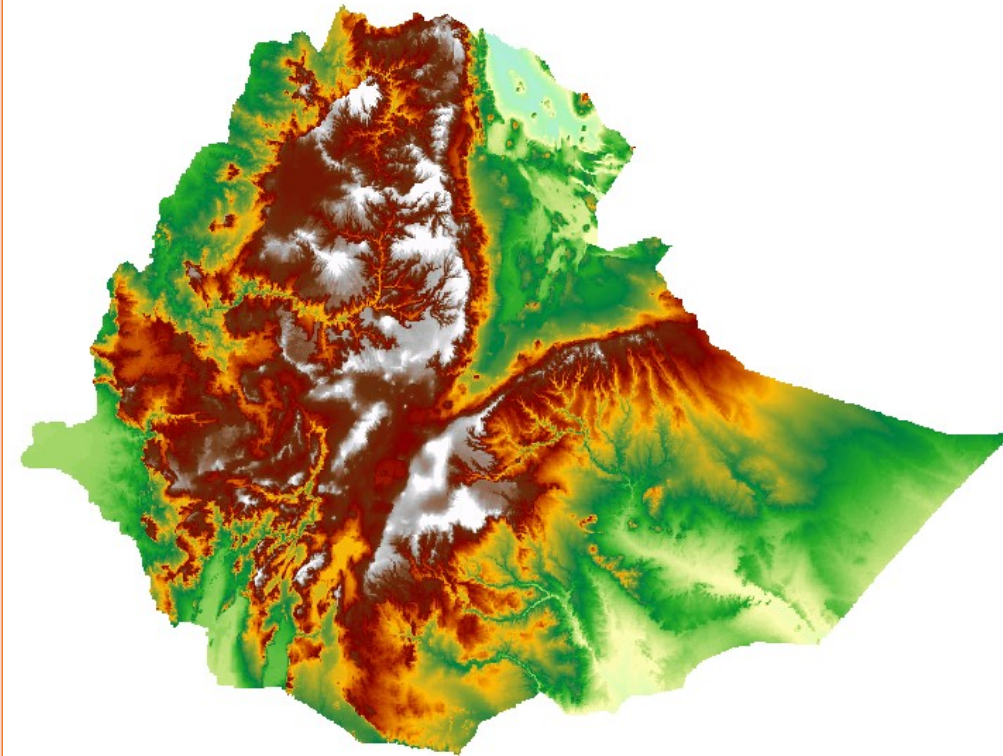




Drainage System of Ethiopia

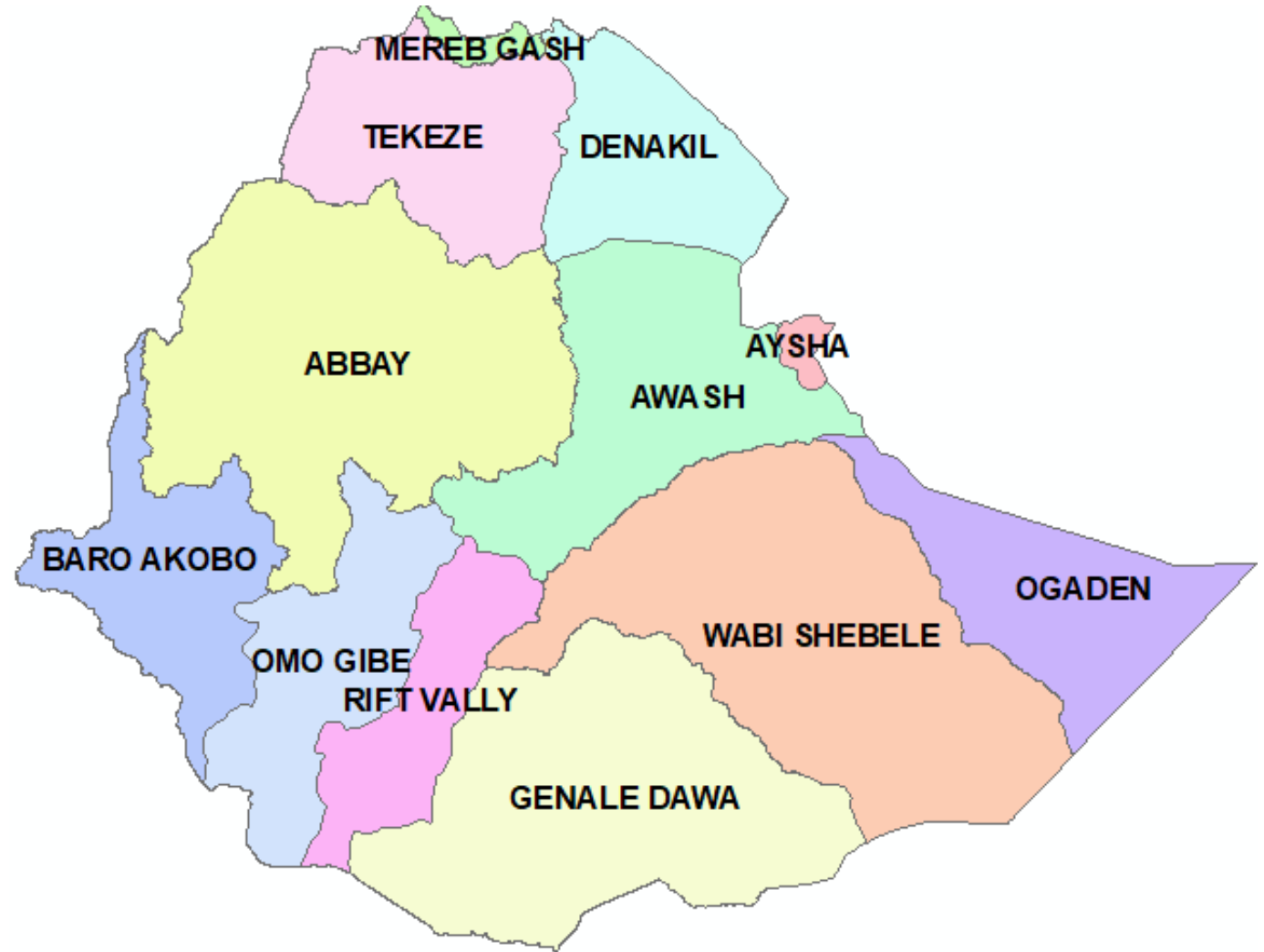
The Rift Valley Drainage System

- is an area of small amount of rainfall, high evaporation and small catchment area.
- The size of the drainage area is restricted by the outward sloping highlands, which starts right from the edge of the escarpment.
- The Rift Valley drainage system is therefore left with the slopes of the escarpment and the Rift Valley floor itself as the catchment area.
- The only major river basin is that of the Awash.



The Ethiopian Rivers

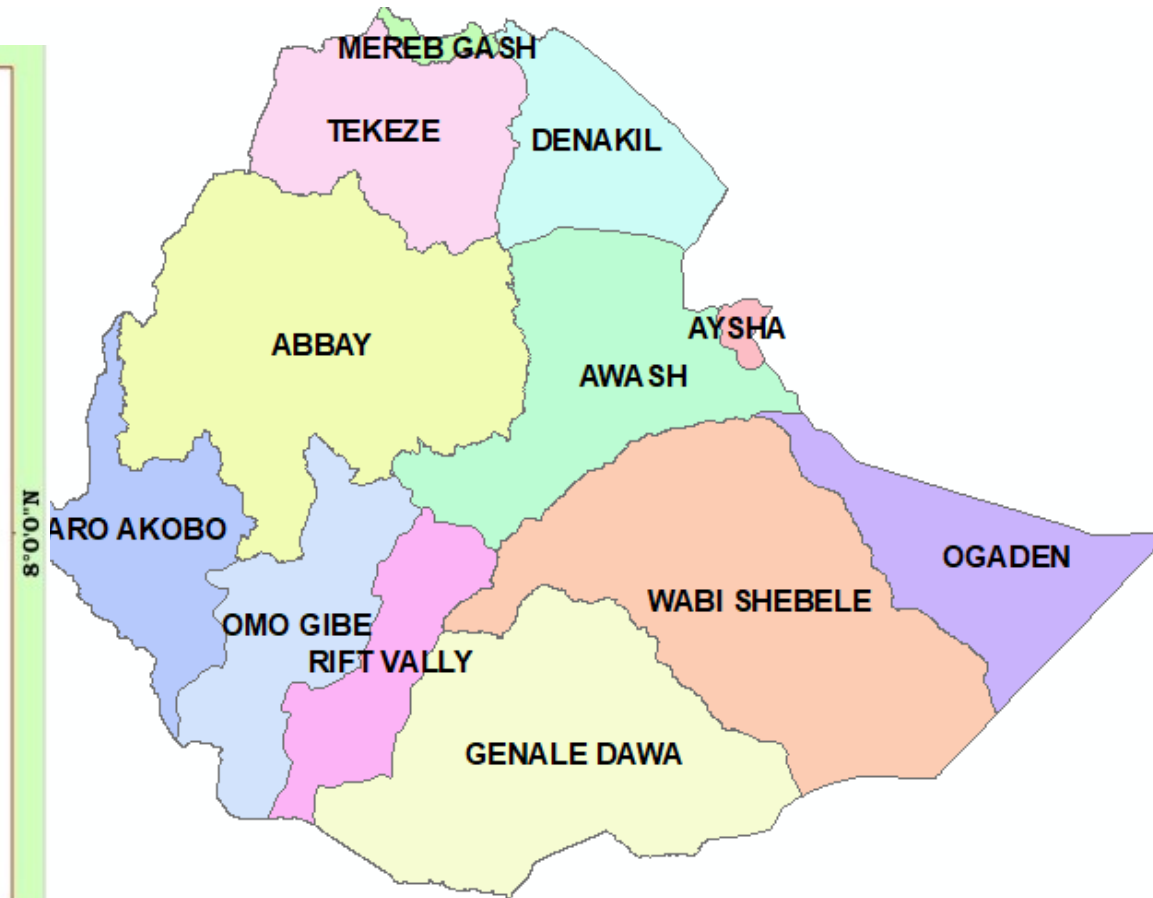
- Ethiopia is endowed with many rivers.
- Majority of the rivers originate from **highland** areas and cross the Ethiopian boundary.
- Altogether, Ethiopian rivers form 12 major watersheds separating the Mediterranean Sea from the Indian Ocean drainage systems.



The Ethiopian Rivers

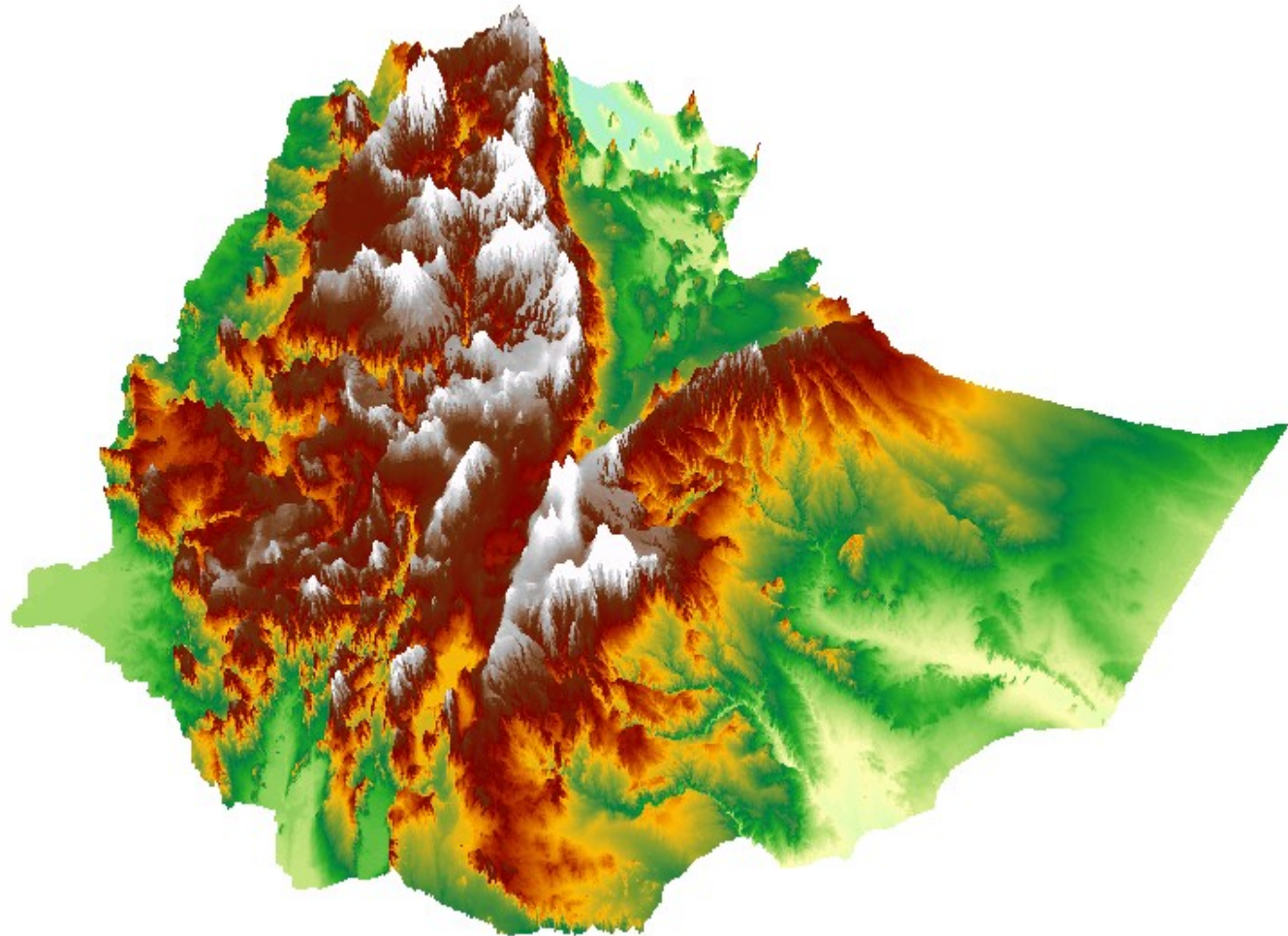
Rivers	Catchment Area (km ²)	Length of Rivers (km)			Major tributaries
		Total	Inside	Outside	
Abay	198508	1360	800	560	Dabus, Dedessa, Fincha, Guder, Muger, Jema, Beshilo
Wabi shebelle	205407	2000	1340	660	Ramis Erer, Daketa, Fafan
Ghenale	168141	1050	480	370	Dawa, Weyb, Welmel, Mena
Awash	113709	1200	1200	0	Akaki, Kesem, Borena, Mile
Tekeze	87733	1168	608	560	Tirari (Atbara, Angereb)
Ghibe (Omo)	77205	760	760	0	Gojeb
Baro	75718	507	227	280	Akobo

The Ethiopian Rivers



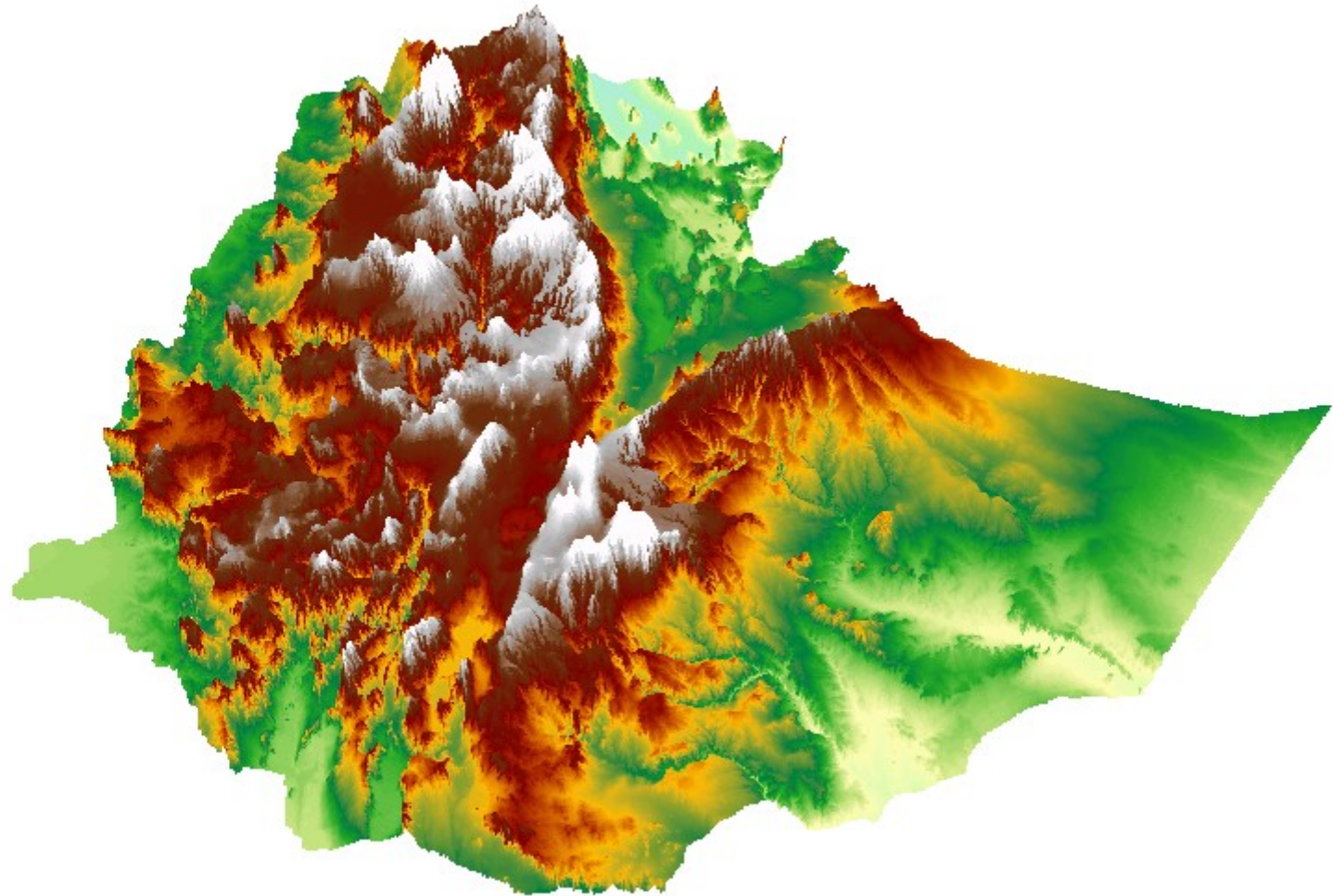
General Characteristics of Ethiopian Rivers

- Major rivers originate from the highlands elevating more than **1500** meters above sea level,
- Majority of Ethiopian rivers are **trans-boundary**.
- Due to the marked seasonality of rainfall, they **show seasonal fluctuation**
- Due to surface ruggedness they **have rapids and waterfalls** along their course



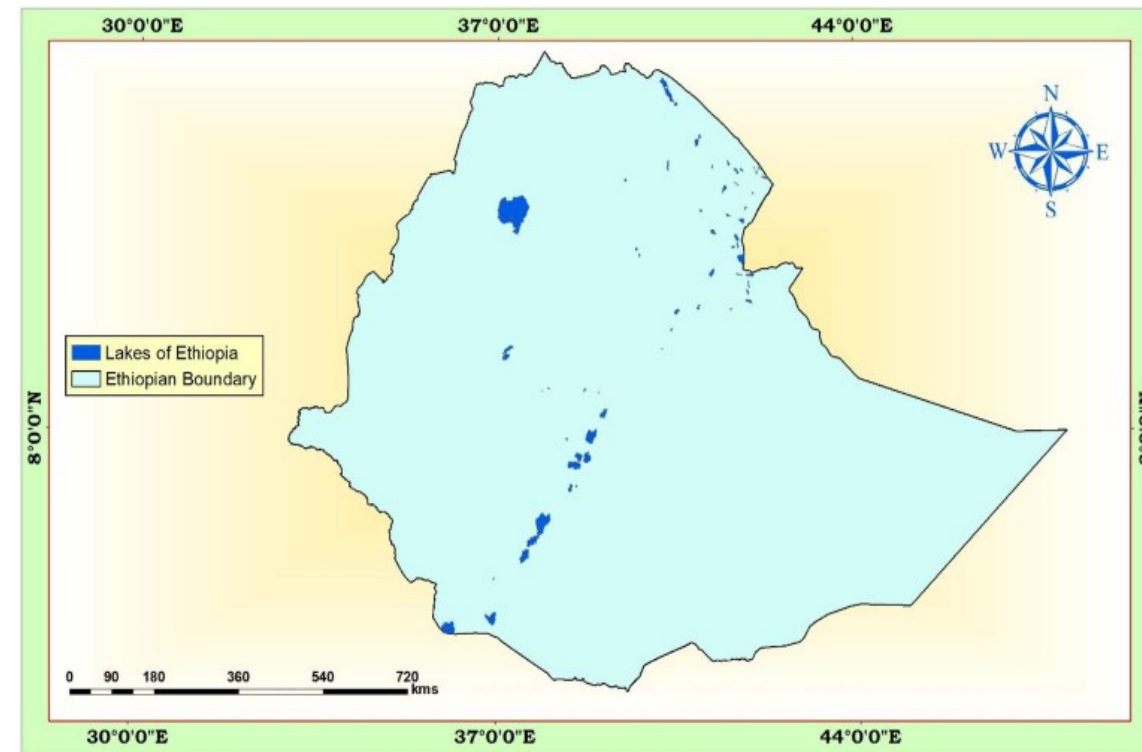
General Characteristics of Ethiopian Rivers

- They have **cuts, steep-sided river valleys** and deep gorges along their courses,
- Rivers in Ethiopia **flow on steep slopes** having steep profiles.
- Some of the rivers **serve as boundaries**, both international and domestic administrative units.



The Ethiopian Lakes

- Relatively Ethiopia is rich in lakes.
- Almost all Ethiopian lakes are result of tectonic process that took place during Quaternary period of Cenozoic era.
- Except few Ethiopian lakes, majority of lakes are located within the **Rift Valley System**.
- The lakes in the drainage are mainly formed on faulted depressions and are clustered along the system forming linear pattern.



The Ethiopian Lakes

Lake	Area(sq. km)	Max Depth (m)	Remark
Tana	3600	9	Largest lake
Abaya	1150	13	Second largest and the largest of all RV lakes
Chamo	551	10	The third largest and the second largest of all RV lakes
Ziway	434	4	The fourth largest and shallowest lake in Ethiopia
Shala	409	266	The deepest lake in Ethiopia
Koka	205	9	Artificial Lake on Awash river
Kabgabi	230	46	
Abiyata	205	14	
Hawasa	229	10	
Ashenge	20	25	
Hayk	5	23	

Subsurface (Ground) Water Resource of Ethiopia

- As compared to surface water resources, **Ethiopia has lower ground water potential.**
- However, there exists higher total exploitable groundwater potential.
- Climatic and geophysical conditions determine the availability of groundwater resource.
- Based on existing scanty knowledge, the groundwater potential of Ethiopia is estimated to be 2.6 - 6.5 BMC.
- However, this estimate is now considered underestimated.
- Considering various separate studies, Ethiopian potential of groundwater is believed to range between 12-30 BMC.

Importance of Ethiopian rivers and Lakes

Hydroelectric power potential

- Ethiopian rivers have a very high potential for generating electricity.

Irrigation and transportation

- The terrain in Ethiopia is so rugged that **it limits the uses of Ethiopian rivers both for irrigation and transportation.**
 - In the highlands, steep slopes, rapids, waterfalls, narrow and deep valleys and gorges are important obstacles.
 - But on the lowlands, their demand for irrigation is high.
- The **Baro at its lower course is the only navigable river.**
 - Comparatively, Ethiopian lakes are much suitable for transportation than rivers.
- Lake Tana and Abaya are relatively the most used for transportation

Importance of Ethiopian rivers and Lakes

Fishing and Recreation

- Ethiopian lakes are rich in fish. Currently the annual production of fish is estimated to be 31.5 thousand tons
- More than 60% of fish supplies are coming from Ethiopian main Rift Valley lakes
- scenic beauty of the lakes, the hot springs around them, the spectacular river gorges and the most impressive waterfalls make Ethiopian rivers and lakes important recreational and tourist attractions

