

Debre Berhan University

College of Social Science and Humanities

Department of Geography and Environmental Studies

Geography of Ethiopia and the Horn

CHAPTER FOUR

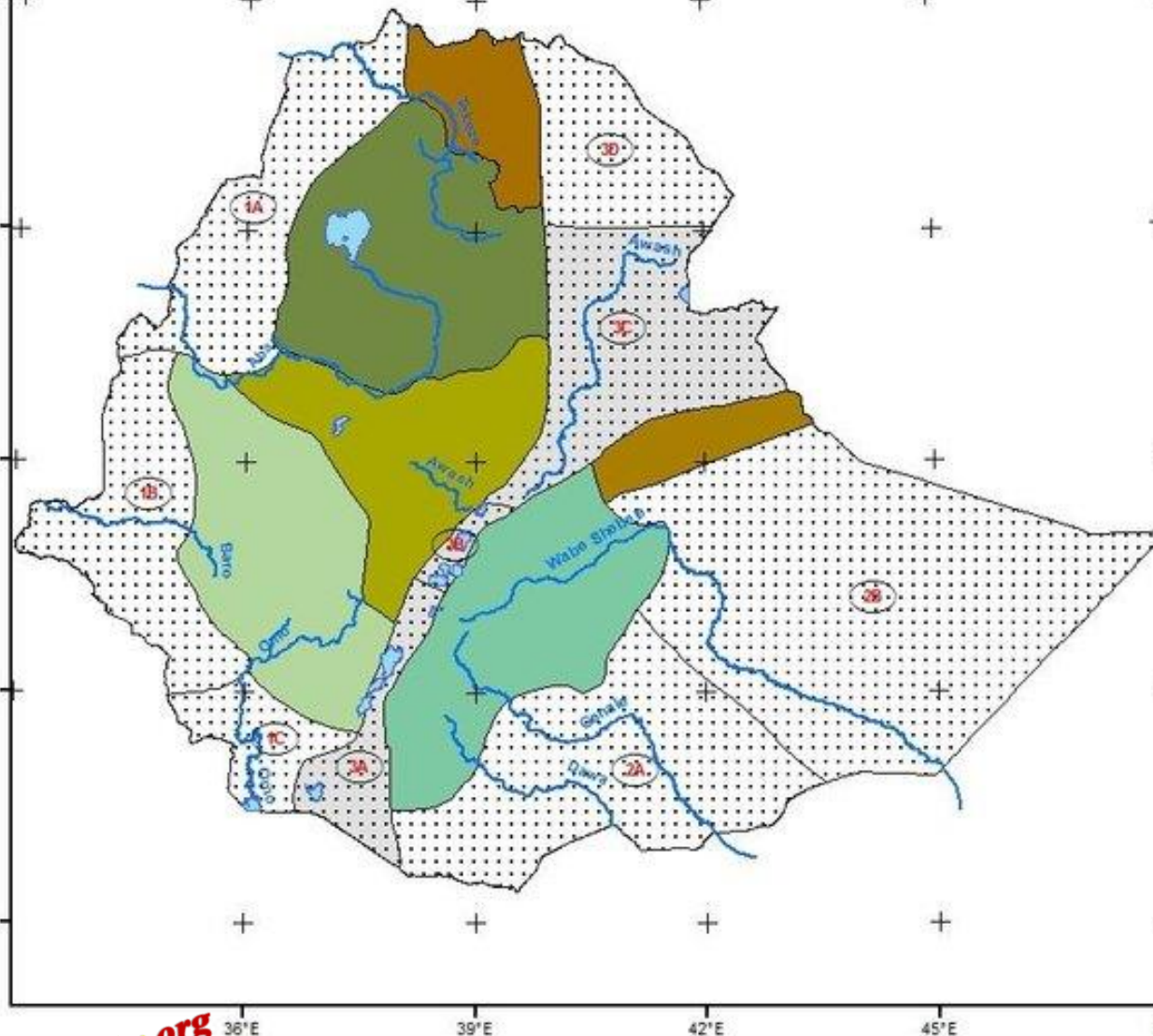
DRAINAGE SYSTEMS AND WATER

RESOURCE OF ETHIOPIA AND THE HORN

By: Ayele Behaylu (Assistant Professor)

November, 2019

Physiographic regions of Ethiopia



LEGEND

I - North-Western Highlands and Associated Lowlands

- The Tigran Plateau
- The North-Central Massif
- The Shewa Plateau
- The South-Western Plateau
- The Angereb Lowlands
- The Baro Lowlands
- The Omo Valley

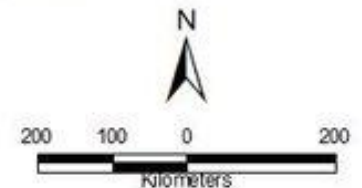
II - The South-Eastern Highlands and Associated Lowlands

- The Arsi-Sidama-Bale Massif
- The Hararghe Plateau
- The Genale Plain
- The Shebele Plain

III - The Ethiopian Rift Valley

- The Southern Rift Valley
- The Central Rift Valley
- The Awash Valley
- The Denakil Depression

- Lakes
- Major Rivers



Source: Adapted from Mesfin Weldemariam, 1972
Prepared by:-Eyasu / Cascape, 2015

4.1. Introduction

- About 71% of the earth's total 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**, of which nearly 68.7% is deposited in glaciers, 30.1% in ground water, 0.8% in permafrost and 0.4% in surface waters.
- Water in **lakes, rivers, atmosphere, soils** and **wetlands** are considered as **surface waters**.

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- ▶ *Surface* and *ground waters* are by far the *most abundant* and *easily available* fresh waters.
- ▶ However, *fresh water* is distributed unevenly throughout the world following *varied latitudinal locations, climatic and topographic setups.*
- ▶ As you have discussed in the third chapter, the *topographic setup of Ethiopia* is characterized by *complex blend of massive highlands, rugged terrain, and low plains.*

- ▶ 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.
- ▶ Although it requires further detailed investigation, 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”*.

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4.2. Major Drainage System of Ethiopia

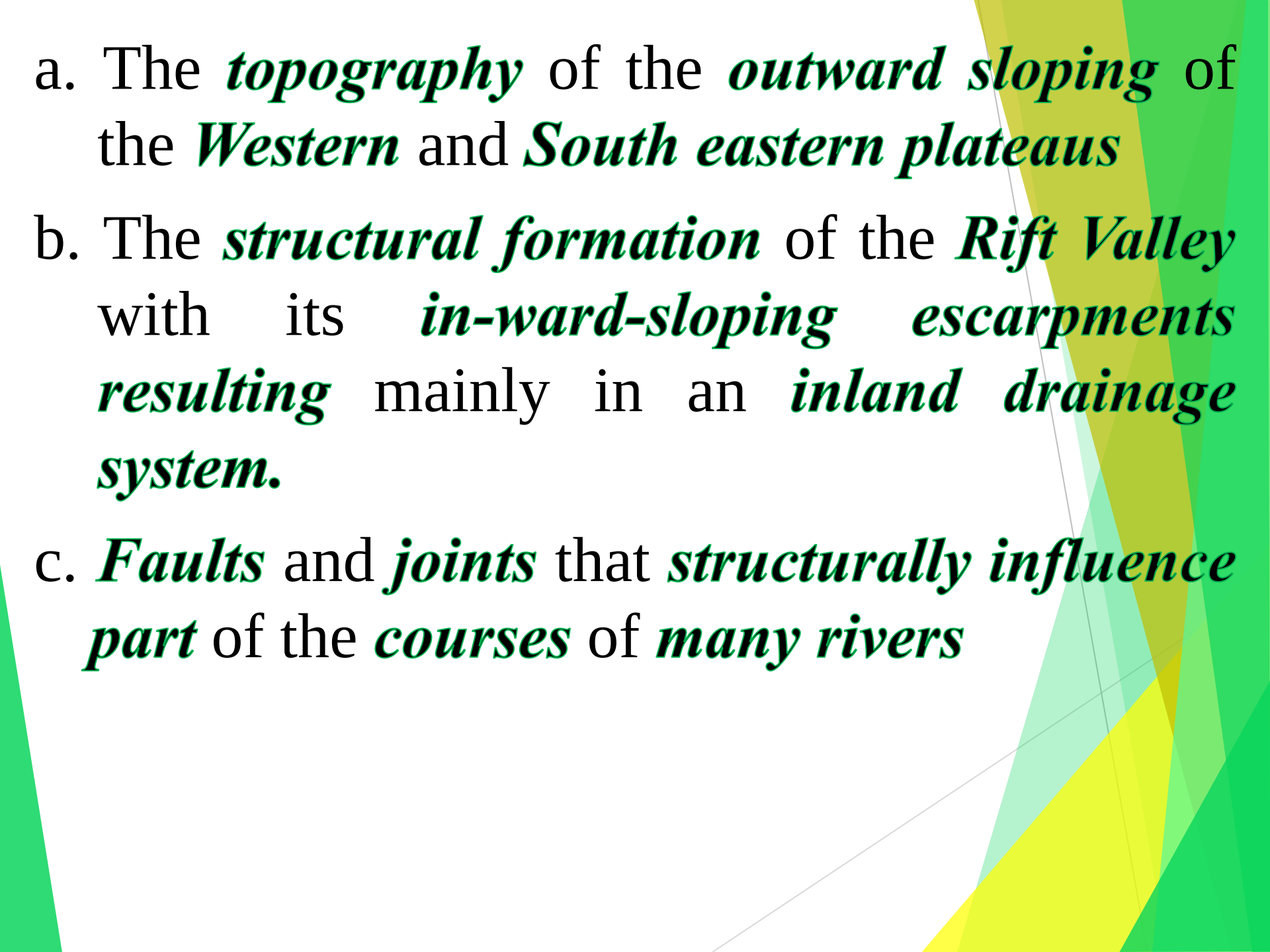
- ▶ The flow of water through well-defined channel is known as *drainage*. www.ayeleby.org
- ▶ A drainage system is made up of a *principal river and its tributaries* (the rivers that flow into it).
- ▶ A river system begins at a place called the *source* or *headwater* and *ends* at a point called *mouth*.

- ▶ Therefore, a ***drainage system*** is branched ***network*** of ***stream channels*** together with the adjacent land slopes they drain.
- ▶ The ***drainage pattern of an area*** is the outcome of the geological processes, nature and structure of rocks, topography, slope, amount and the periodicity of the flow.

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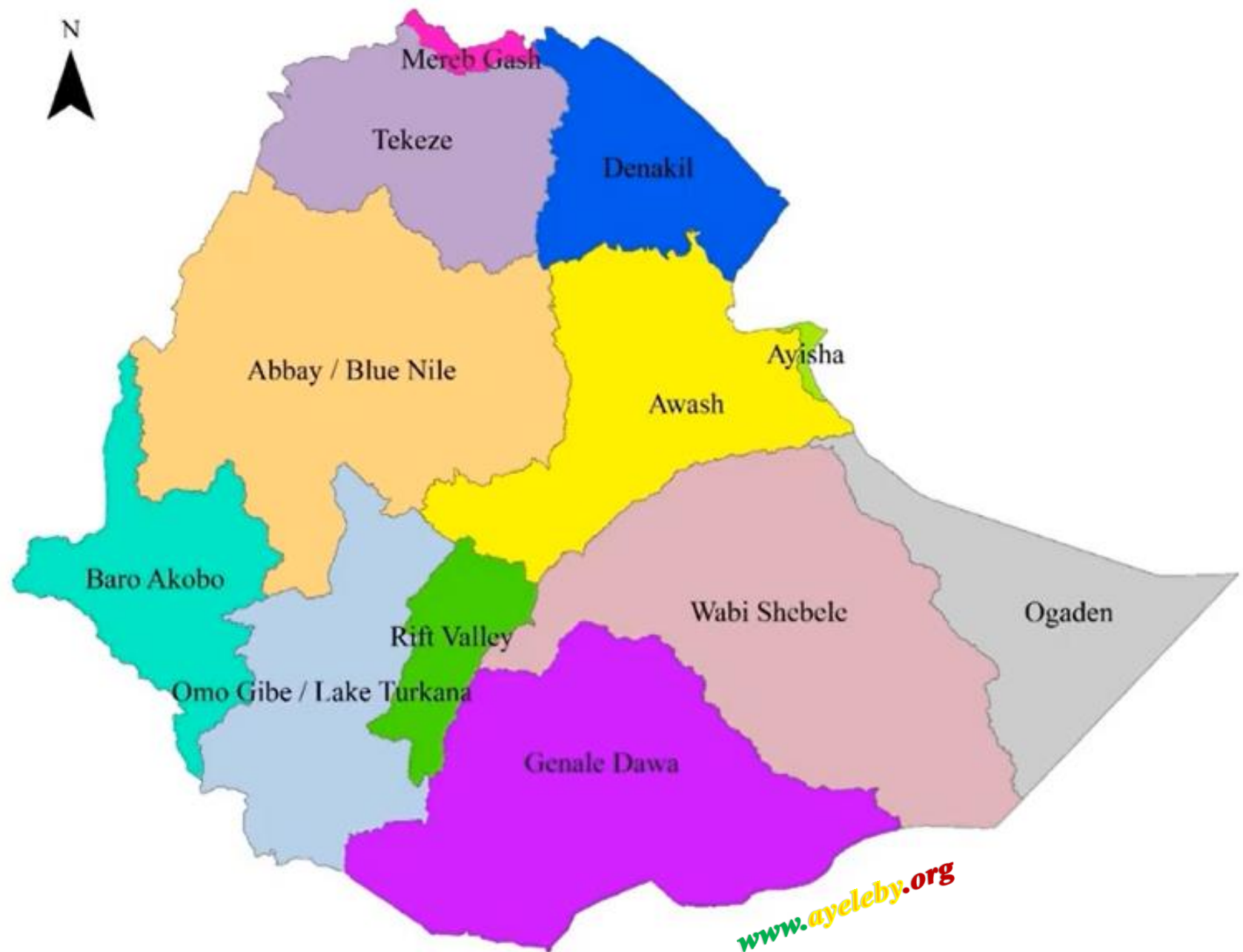


- ▶ A **drainage basin** is the *topographic region* from which a river and its tributaries collect both the ***surface runoff*** and ***subsurface flow***.
- ▶ It is bounded by and separated from other river basins by a ***water divide*** or ***topographic divide***.
- ▶ The general patterns of major river basins in Ethiopia are determined by ***topographical structures*** which can be clarified as:-

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

The Major Drainage Systems

- ▶ Why do rivers rise from higher slope and flow towards the lower?
- ▶ Following the *complex physiographic setup* and *geological makeup*, Ethiopia possesses *three broadly classified drainage systems* namely *Western*, *Southeastern* and *Rift Valley Drainage* Systems.
- ▶ *Western* and the *Southeastern drainage systems* are separated by the *Rift Valley system*.



0 87.5 175 350 525 700 Km

Image Credit : Abebe T.

4.2.1. The Western Drainage Systems

- ▶ 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*.
- ▶ Most of the catchment area coextends with the *westward sloping part* of the *western highlands* and *western lowlands*.

- ▶ This drainage system comprises *four major river basins* namely the *Tekeze, Abay, Baro-Akobo, Ghibe (Omo)*.
- ▶ Unlike other river basins in the system, the *Ghibe (Omo) flows southward*.
- ▶ The *Abay, Tekeze* and *Baro* flow *westward* ultimately joining the *Nile* which finally ends at *Mediterranean Sea*.

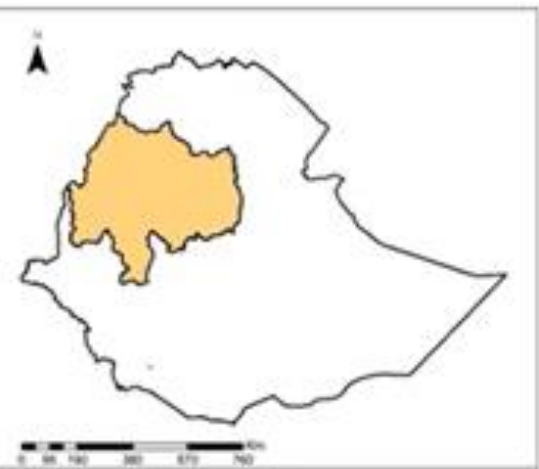
▶ The *largest river* both in *volumetric discharge* and *coverage* in the *western drainage systems* is the *Abay* .

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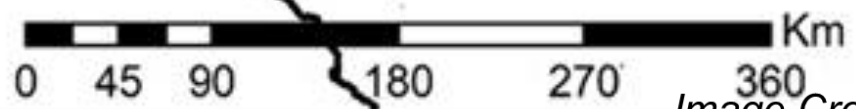
▶ *Abay river basin* covers an area of 199,812 km², covering parts of Amhara, Oromia and Benishangul-Gumuz regional states.

▶ Together with its tributaries, most of which are left-bank tributaries; it carries *65 percent of the annual water flow of the region*.

- ▶ *Abay* which *rises from Lake Tana* (some sources indicate its origin from Sekela, Choke mountain) *flows* about *1,450 kilometres* and *joins* the *White Nile* in *Khartoum, Sudan* to *form* the *Nile River*.
- ▶ More than *60 streams* drain the Abay within elevation ranging between *500 - 4261* meters above sea level.
- ▶ The largest of these is *Ghilgel Abay* (Little Abay).

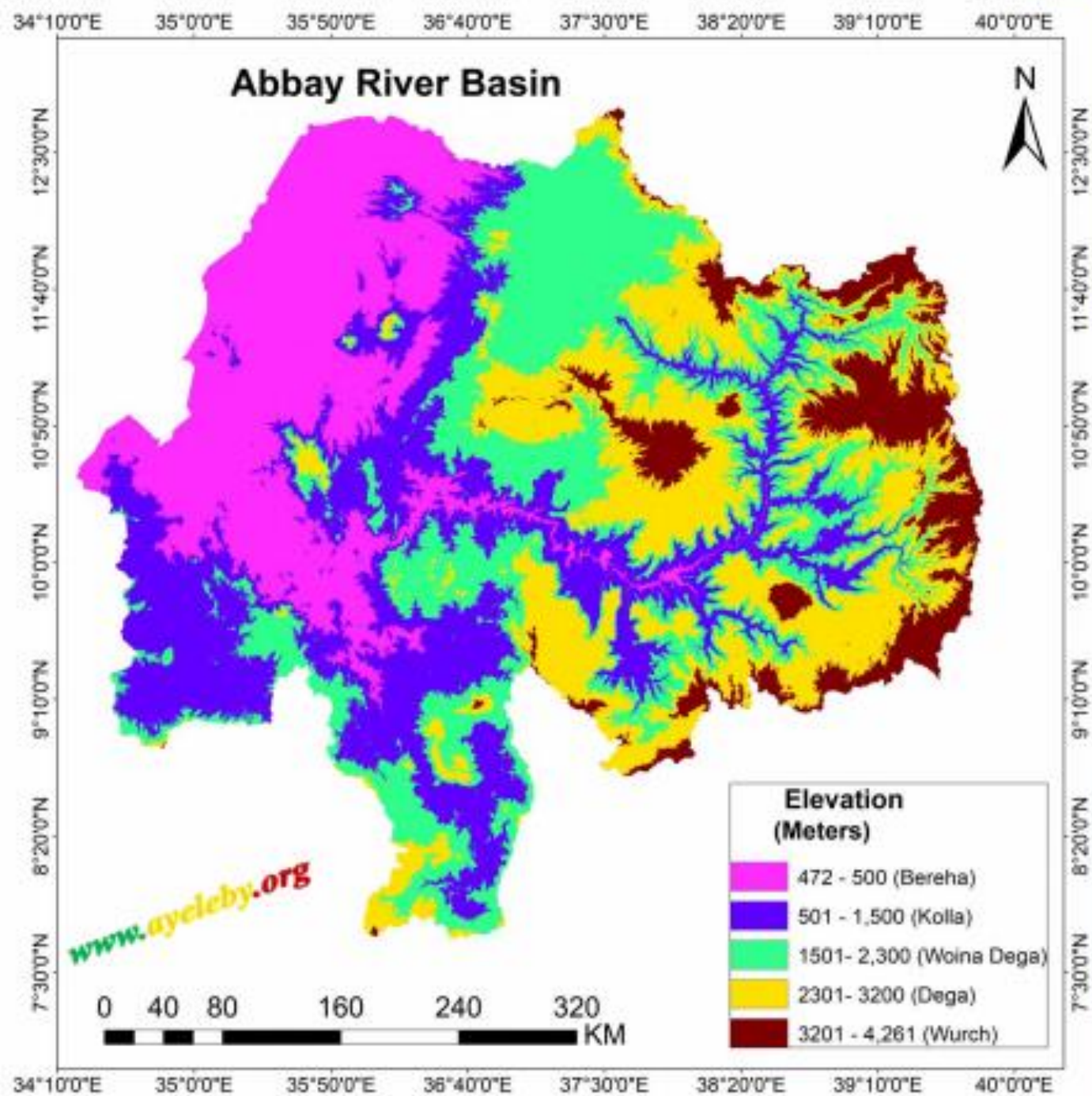


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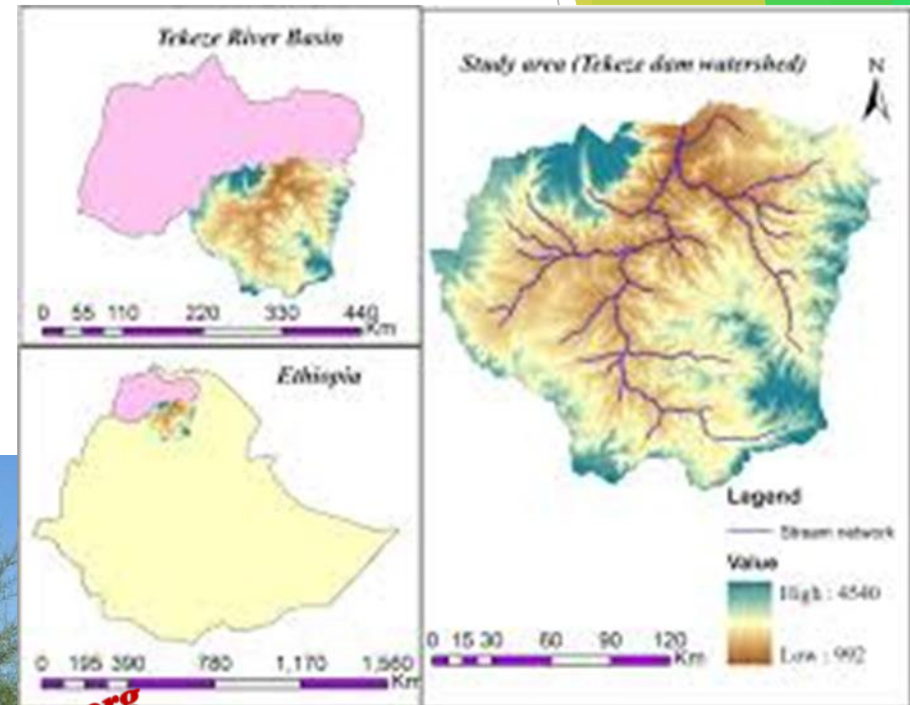
Abbay (Blue Nile – Tana)	
Source	
West Gojam	
Terminal	
Sudan Border	
Area (km ²)	
200,718	
Water Resource (BCM)	
54.4	

Image Credit : Abebe T. (HU. Inst. of Tech)

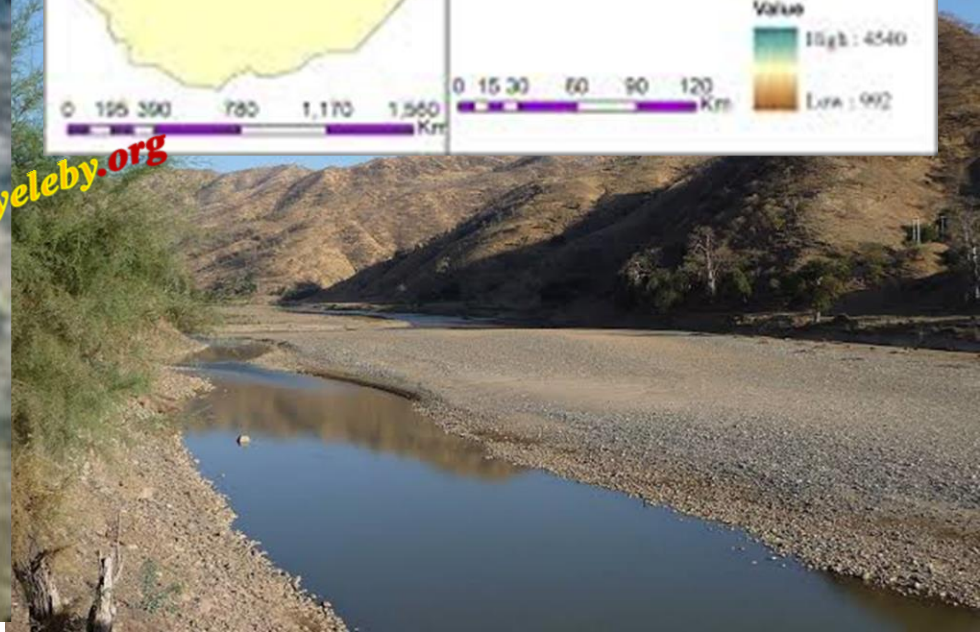


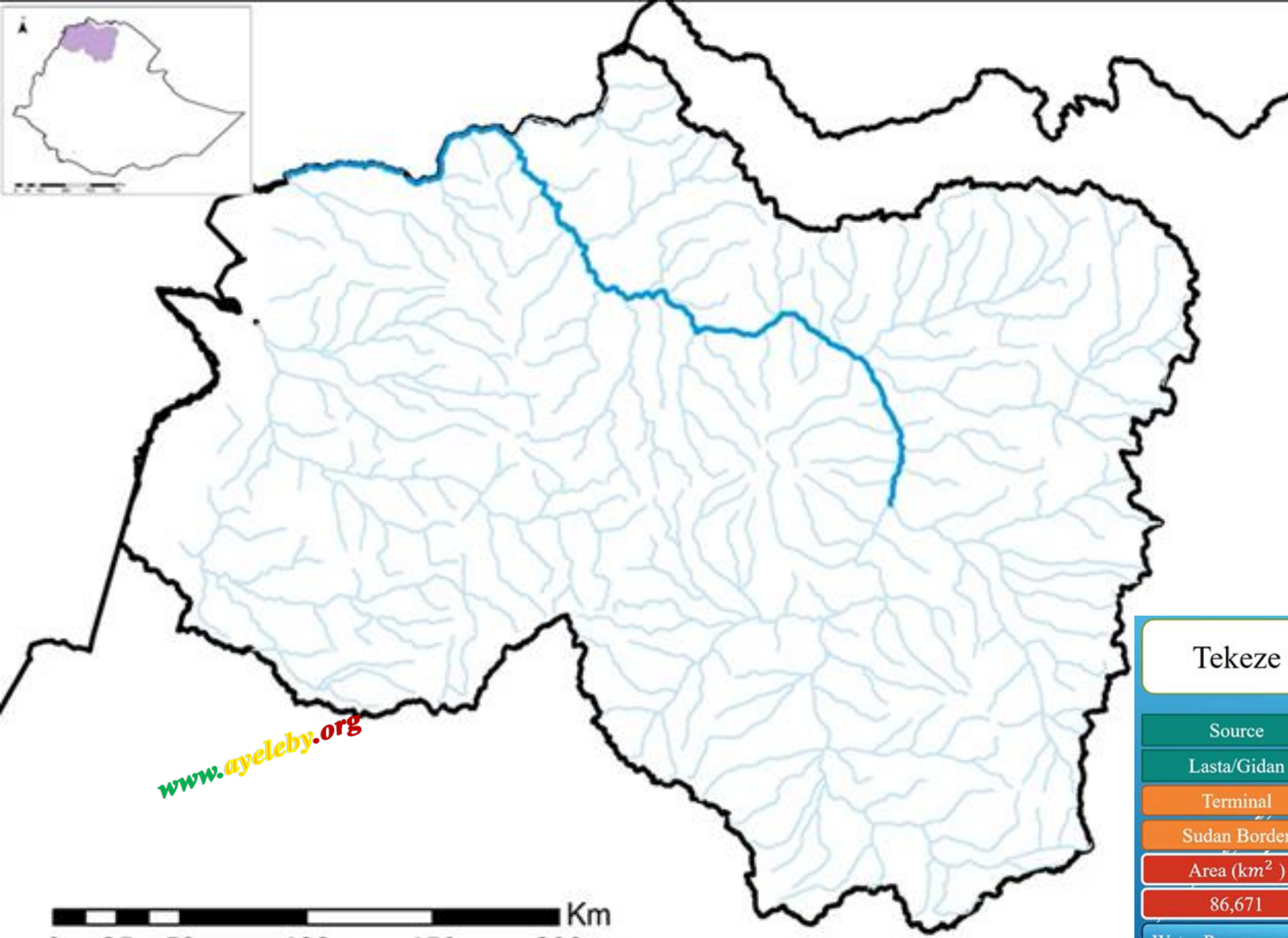


Tekeze gorge



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Tekeze

Source

Lasta/Gidan

Terminal

Sudan Border

Area (km²)

86,671

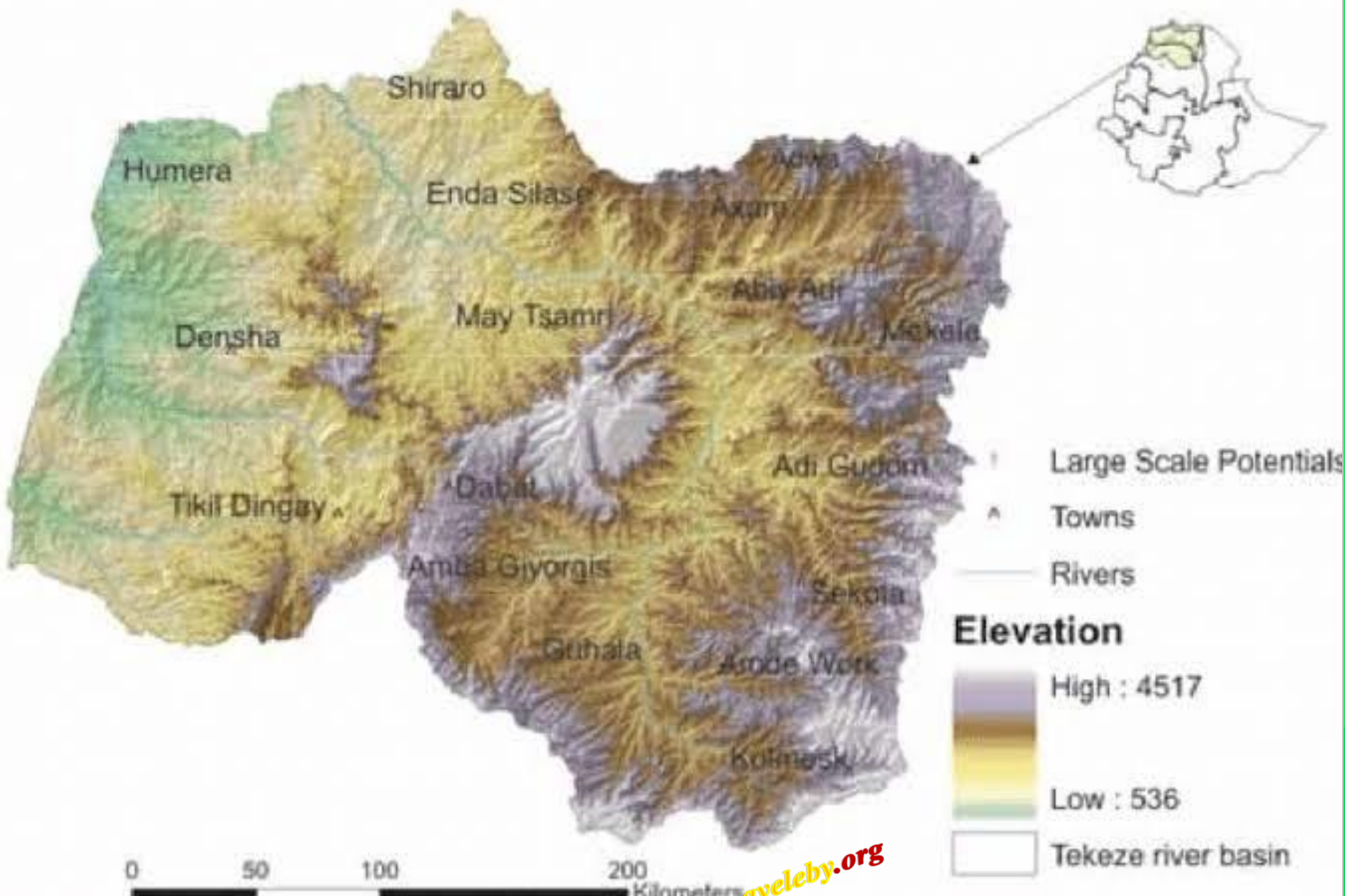
Water Resource (BCM)

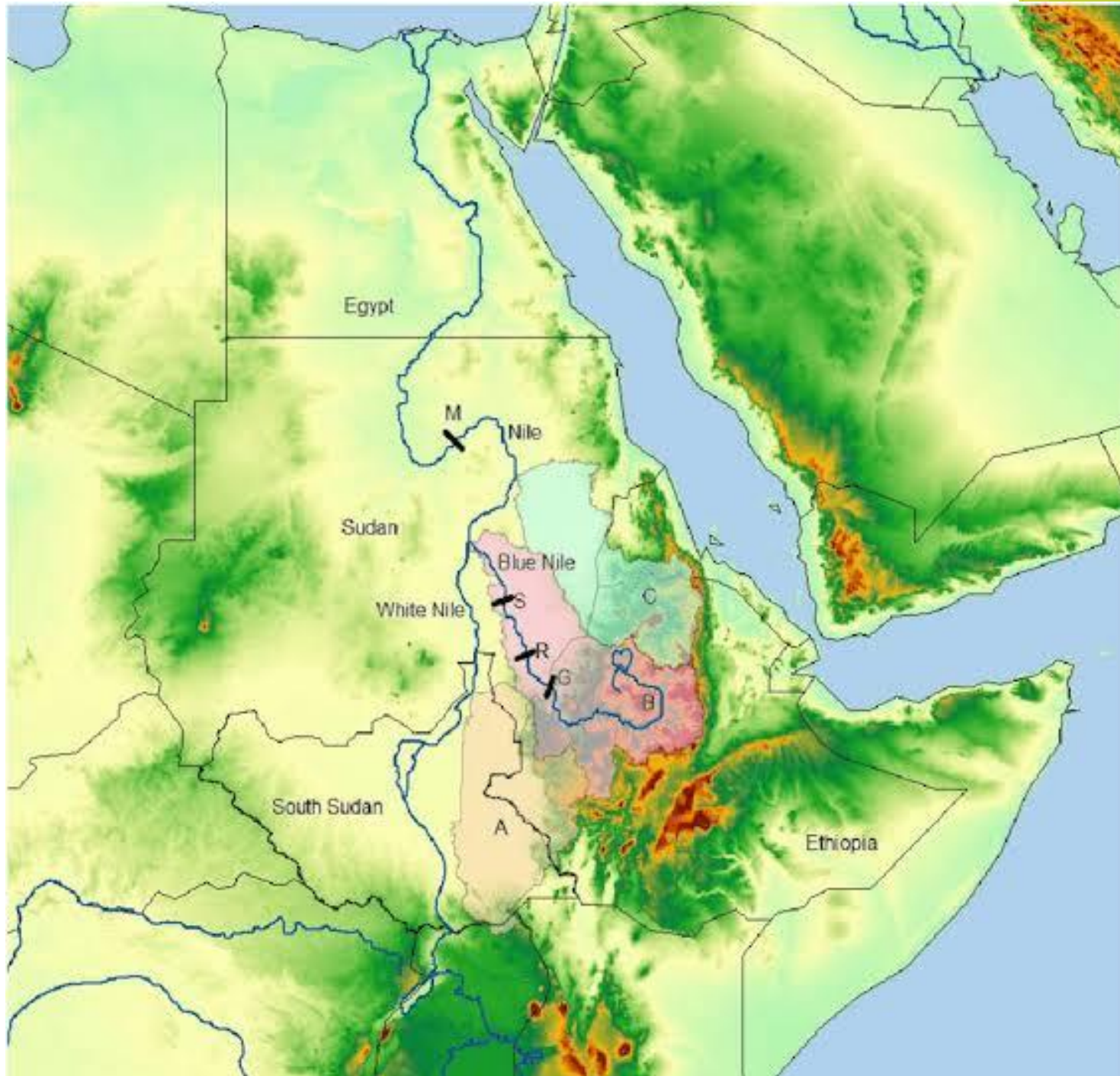
8.2

Image Credit : Abebe T. (HU. Inst. of Tech)

- ▶ *Abay* flows *eastward*, turns 180° to make a large bend and after cutting an impressive and deep gorge emerges out in the west.
- ▶ Similarly, the *Tekeze* and its tributaries, carrying *12* percent of the annual water flow of the region drains *82,350* Km² of land surface within elevation ranging between *536-4517* meters above sea level.
- ▶ *Erosion* in the basin resulted in large tablelands, *plateau blocks* and *isolated mountain* groups.

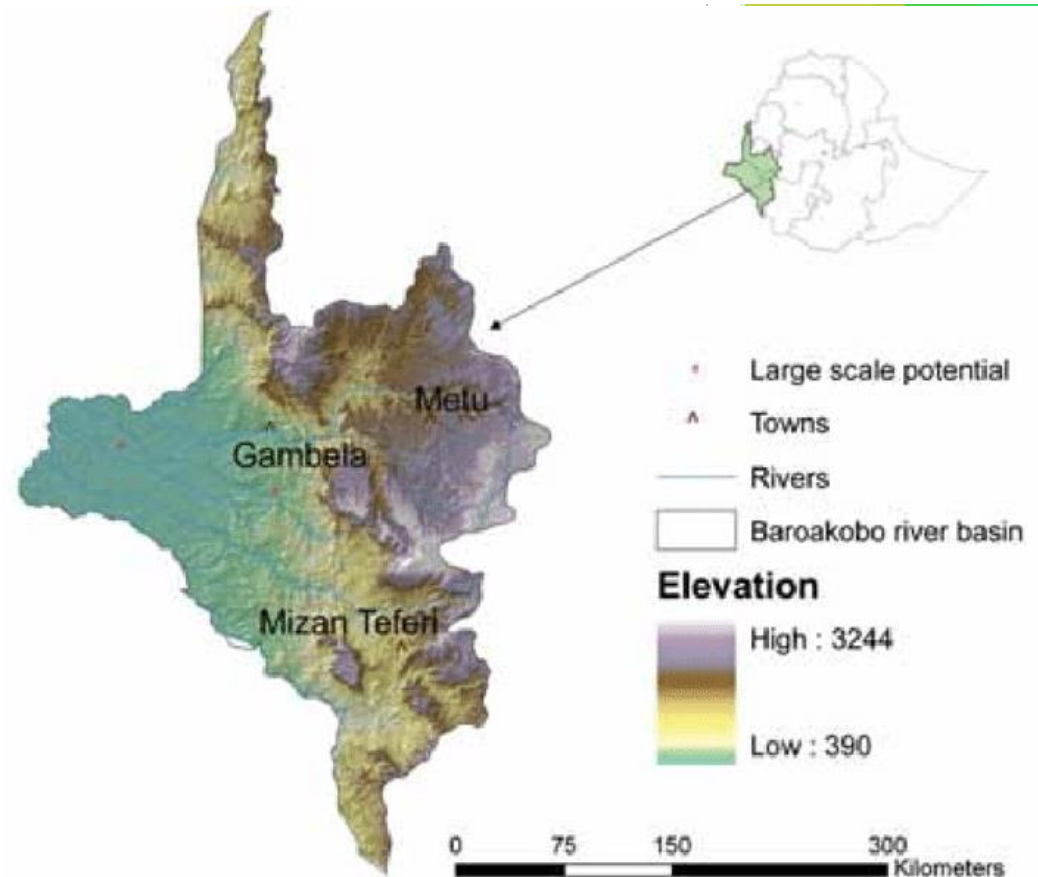
- ▶ The basin has *two main tributaries* (*Angereb* and *Goang*) which rises in the central highlands of Ethiopia.
- ▶ *Tekeze River* is termed *Atbara* in *Sudan*, which is a *tributary* of the *Nile*.
- ▶ The *total mean annual flow* from the basin is estimated to be *8.2 billion metric cubes* (BMC, here after).





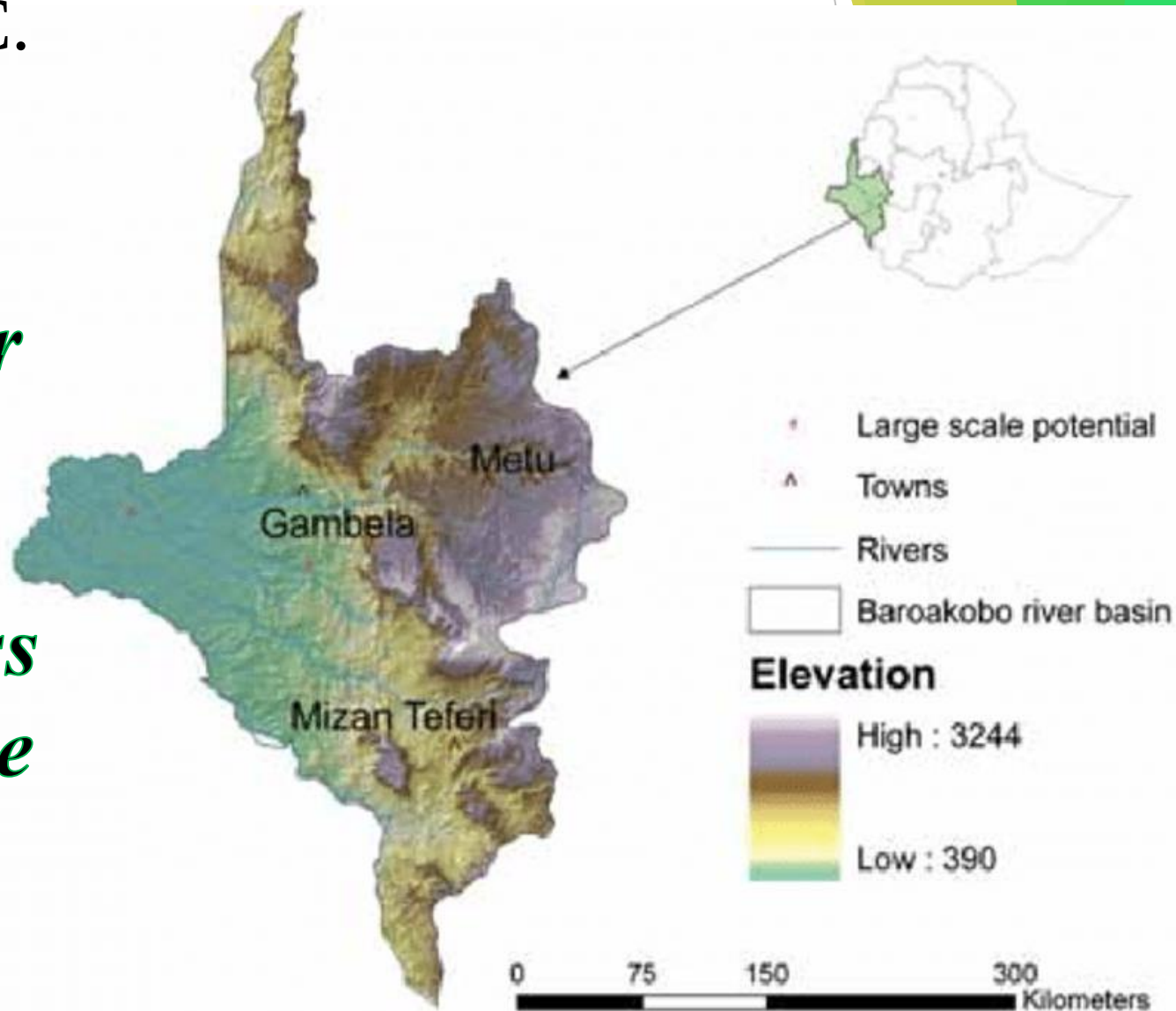
- The **Baro-Akobo** and **Ghibe / Omo** rivers drain the wettest highlands in the south and southwestern Ethiopia.

- They *carry 17 percent* and *6 percent* of the annual water flow respectively.



➤ The *Ghibe/ Omo river basin* drains an area of **79,000** km² with an estimated mean annual flow of **16.6** BMC.

➤ In the *lower course*, the *Baro* River flows across an *extensive marshy land*.



- Baro-Akobo river basin has an area of 75,912 km², covering parts of the *Benishangul-Gumuz, Gambella, Oromia, and SNNPR*.
- The total mean annual flow from the river basin is estimated to be *23.6 BMC*.
- The *Baro* together with *Akobo* forms the *Sobat River* in *South Sudan*.



Baro-Akobo

Source

Illubabor

Terminal

Sudan Border

Area (km²)

75,604

Water Resource (BCM)

23.23

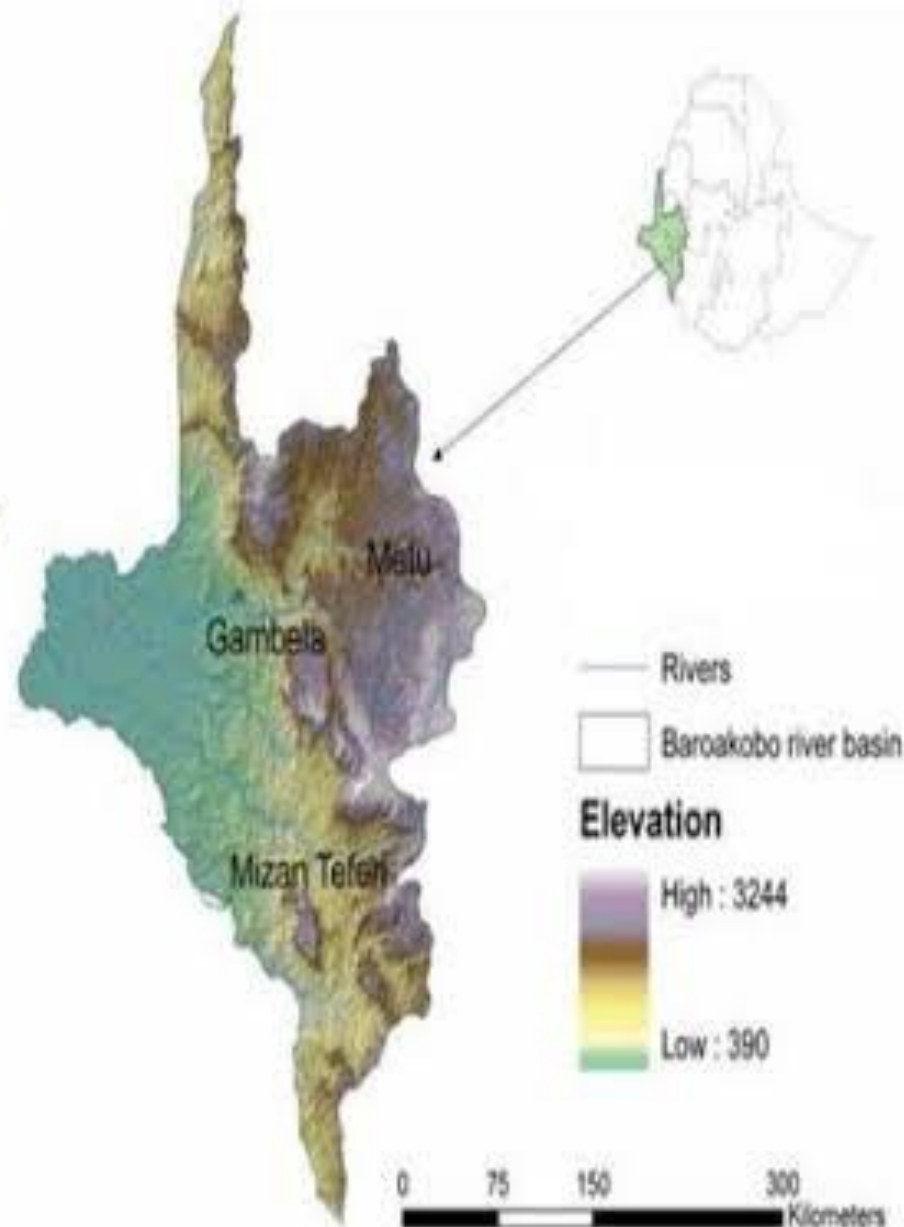
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Image Credit : Abebe T. (HU. Inst. of Tech)

0 45 90 180 270 360 Km

Baro Akobo

- The Baro-Akobo Basin lies in the southwest of Ethiopia
- The basin area is about 76,000 km² and is bordered by the Sudan in the west, northwest and southwest, Abbay and Omo-Ghibe Basins in the east.
- About 31% of the basin falls in Oromiya, 9.8% in Benshangul-Gumuz, 24.6% in SNNRP and 34.3% in Gambela. The lower basin accounts for about 42% of the basin area.





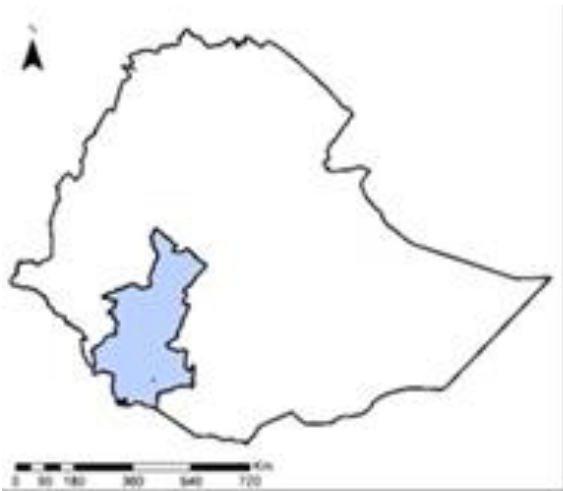
The *Ghibe / Omo River* finally empties in to the *Chew-Bahir* at the *mouth* of *Lake Turkana* (an elongated Rift Valley lake) thereby forming an *inland drainage*.

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www.guidetoEthiopia.com

Guide to
ETHIOPIA





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Omo-Gibe

Source

Ambo

Terminal

Rudolph Lake

Area (km²)

98,091

Water Resource (BCM)

16.6

Image Credit : Abebe T. (HU. Inst. of Tech)

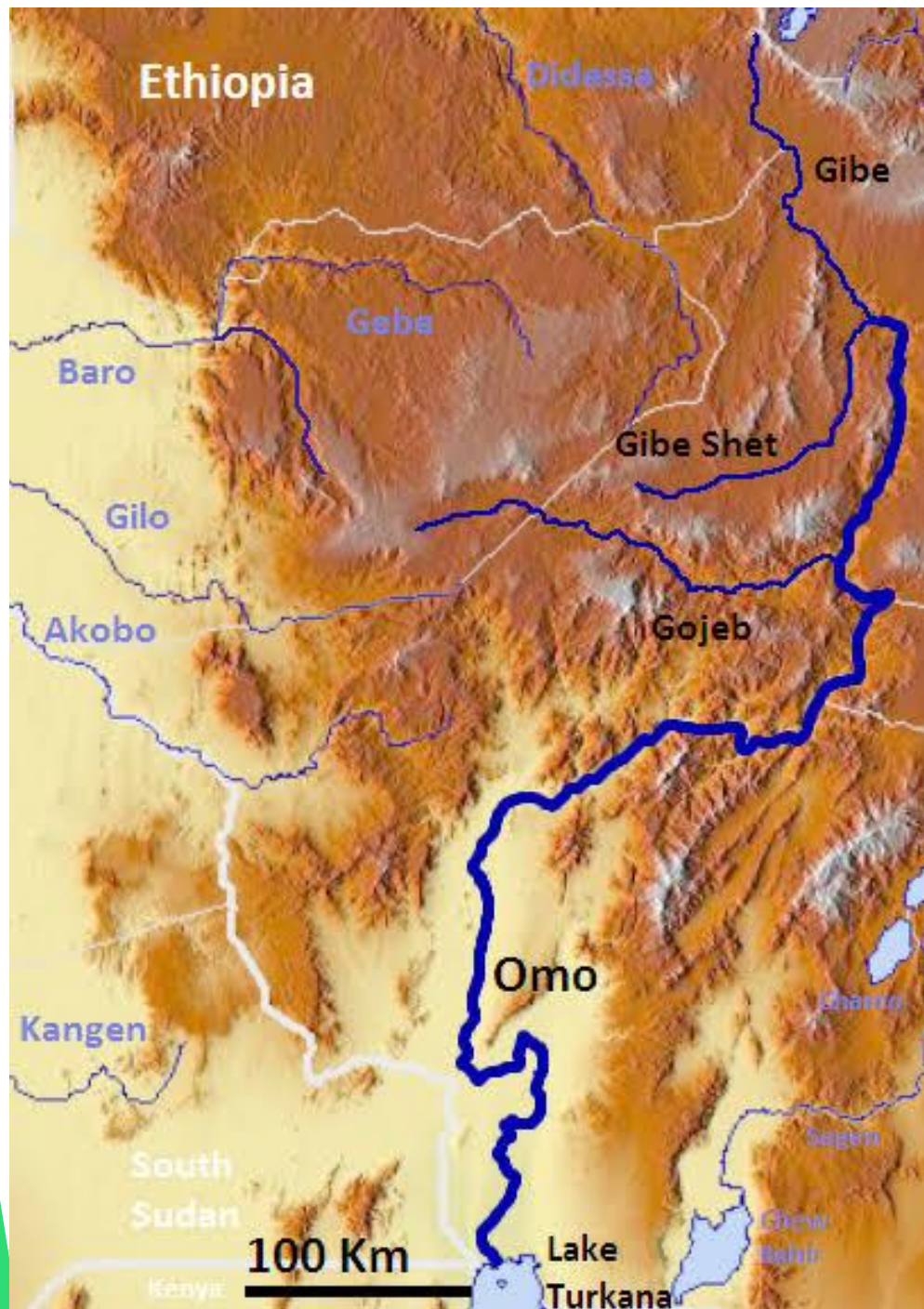




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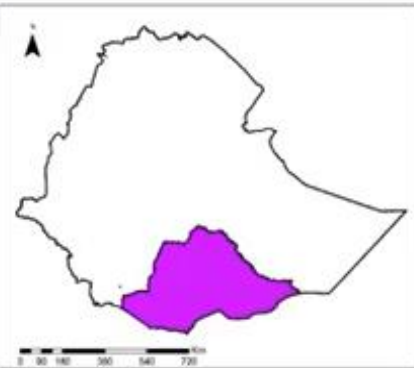
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4.2.2. The Southeastern Drainage Systems

- ▶ Nearly the *entire physiographic region of southeastern part of Ethiopia* is drained by the *southeastern drainage systems*.
- ▶ The **basin** which is mainly drained by **Wabishebelle** 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.

- ▶ ***Ghenale*** River basin has an area of ***171,042*** km², covering parts of ***Oromia***, ***SNNPR***, and ***Somali*** regions.
- ▶ ***Ghenale***, which has fewer tributaries but carries more water than ***Wabishebele***, reaches the ***Indian Ocean***.
- ▶ The basin flows estimated to be ***5.8 BMC*** within elevation ranging between ***171-4385*** meters above sea level.
- ▶ In ***Somalia*** it is named the ***Juba River***.

- ▶ **Wabishebelle** with a total catchment area of 202,697 km², is the largest river in terms of catchment area.
- ▶ It drains parts of *Oromia*, *Harari* and the *Somali* regions.
- ▶ It is the *longest river in Ethiopia*. www.ayeleby.org
- ▶ Its tributaries are mainly left bank and, most of them, are intermittent.
- ▶ Despite its size, the *Wabishebelle fails to reach the Indian Ocean* where at the end of its journey it flows parallel to the coast before its water disappears in the sands, just near the Juba River.



Genale-Dawa

Source

Bale Mountains

Terminal

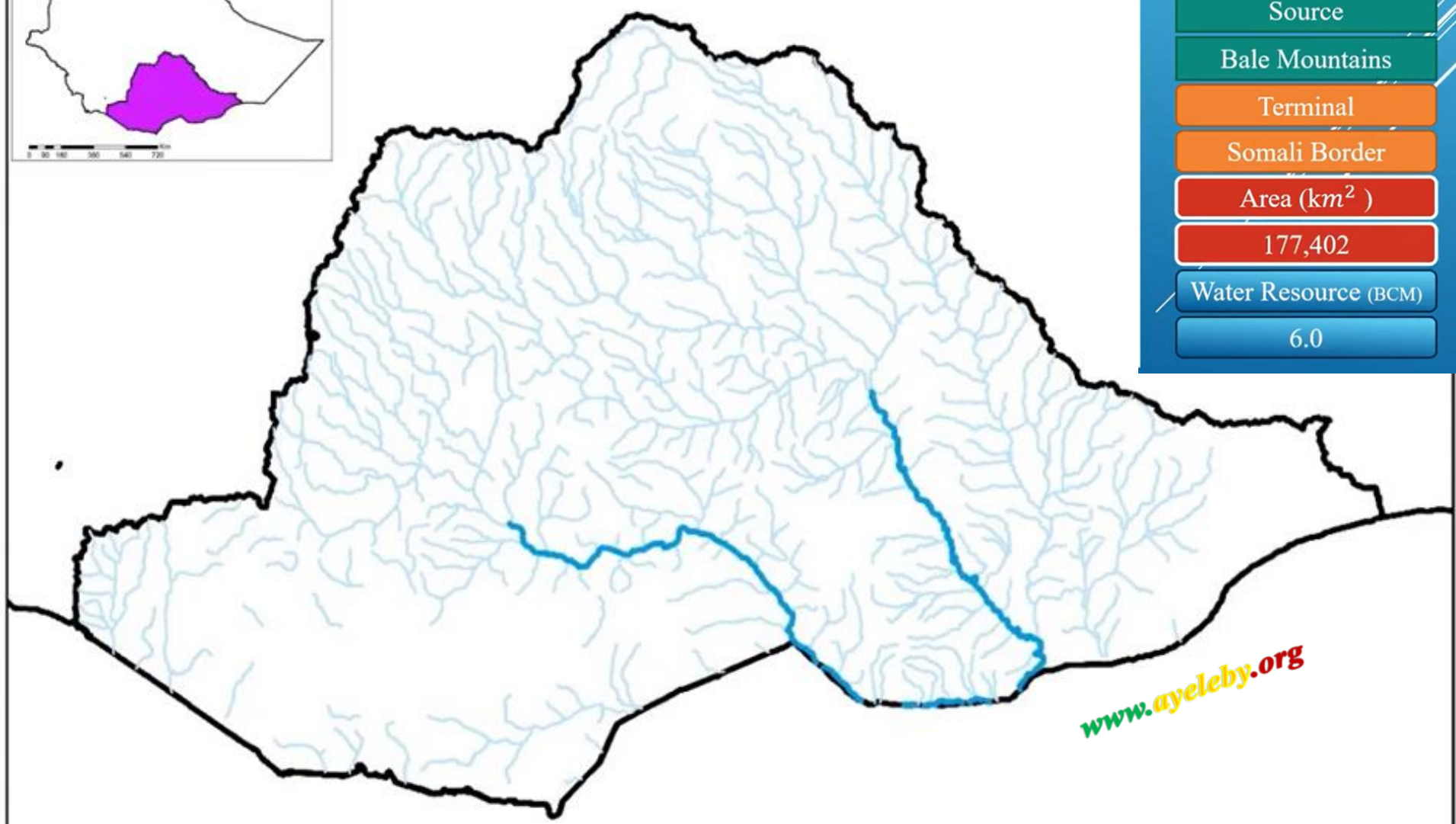
Somali Border

Area (km²)

177,402

Water Resource (BCM)

6.0



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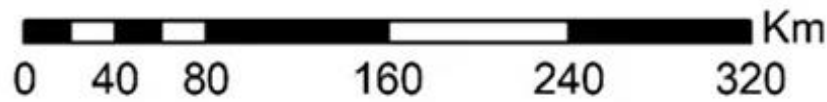
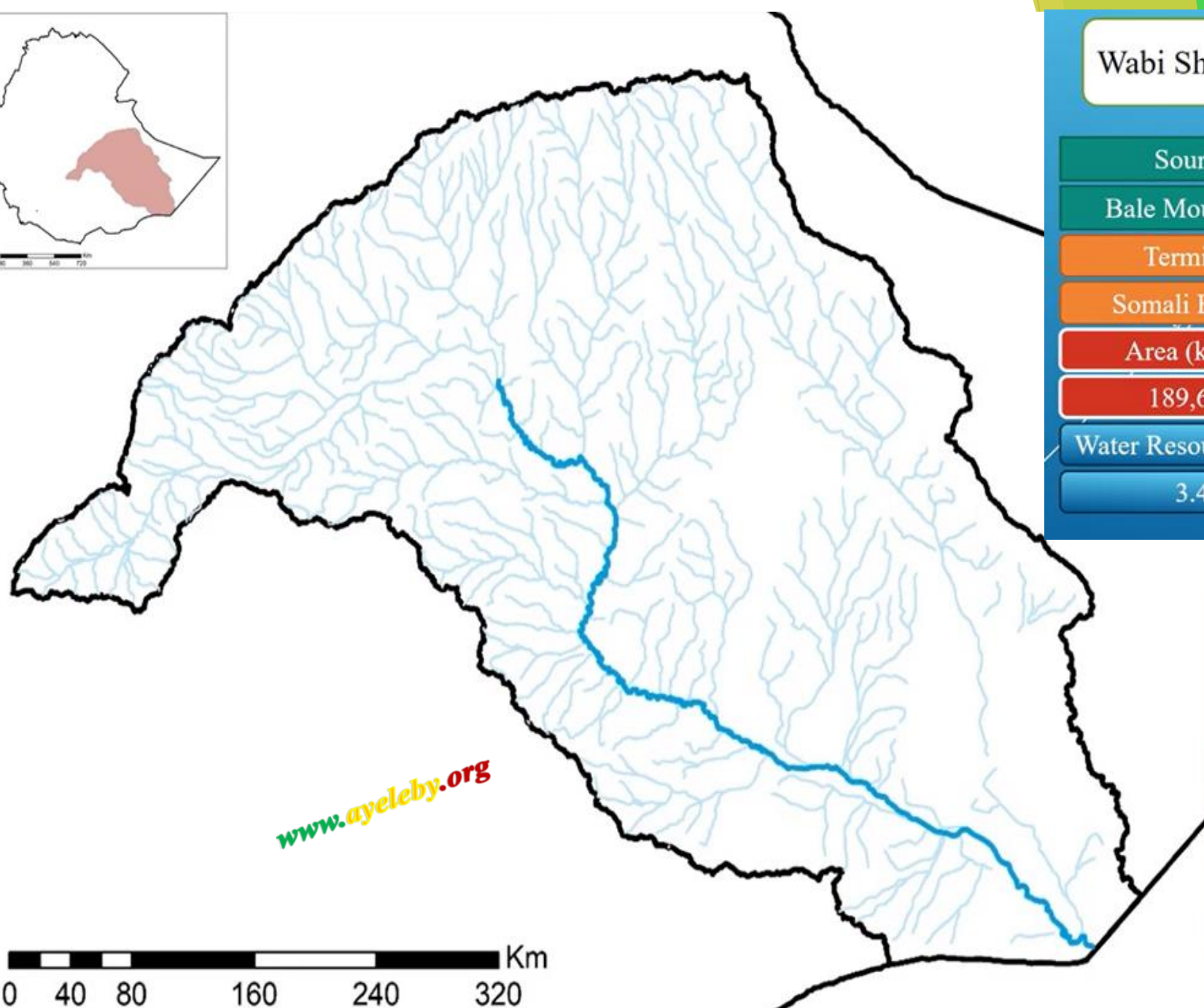


Image Credit : Abebe T. (HU. Inst. of Tech)



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Wabi Shebele

Source

Bale Mountains

Terminal

Somali Border

Area (km²)

189,660

Water Resource (BCM)

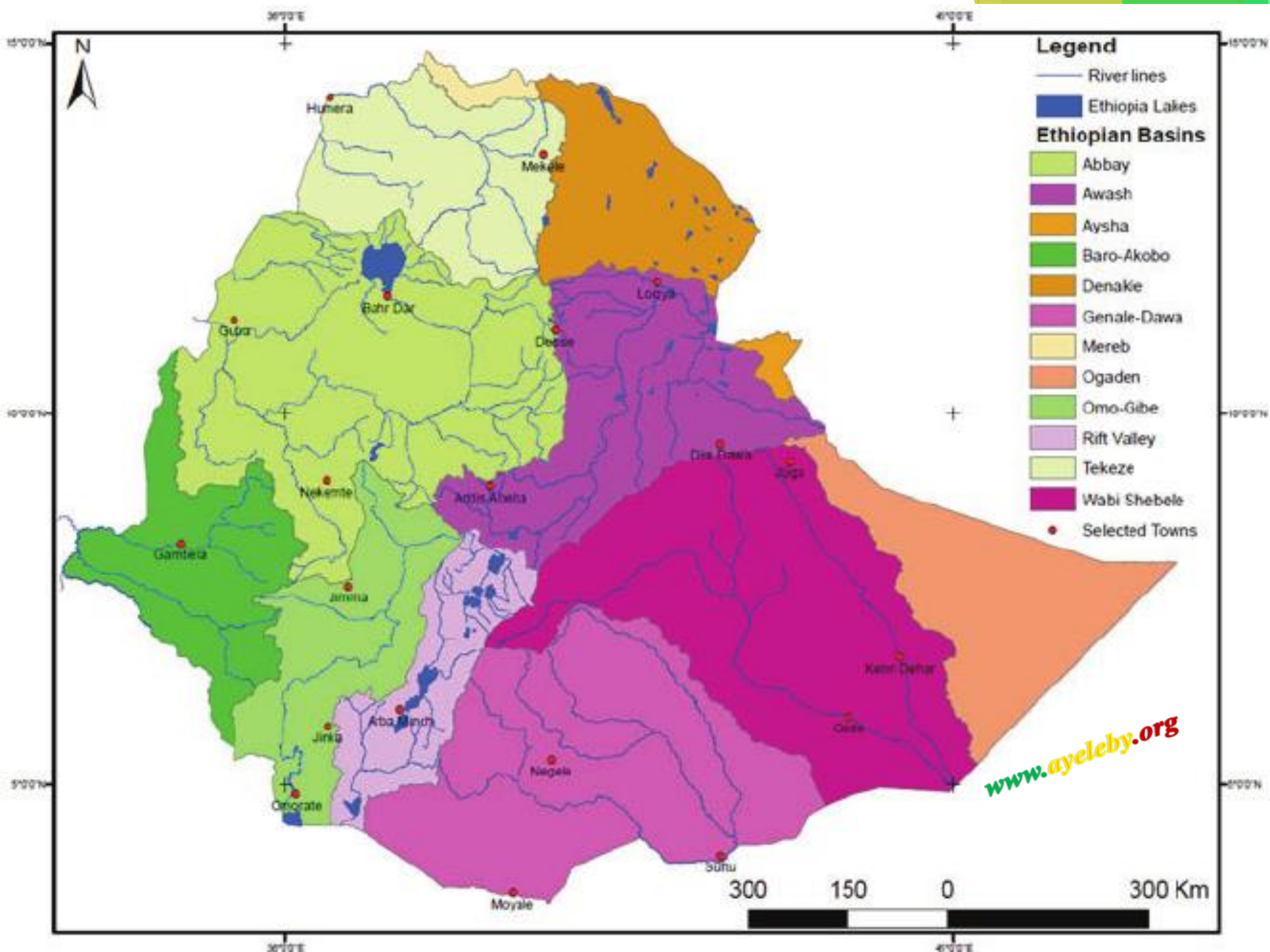
3.4

Image Credit : Abebe T. (HU. Inst. of Tech)



Figure 4.1. Drainage Basins of Ethiopia

Source: CSA shapefile, 2012



4.2.3. The Rift Valley Drainage System

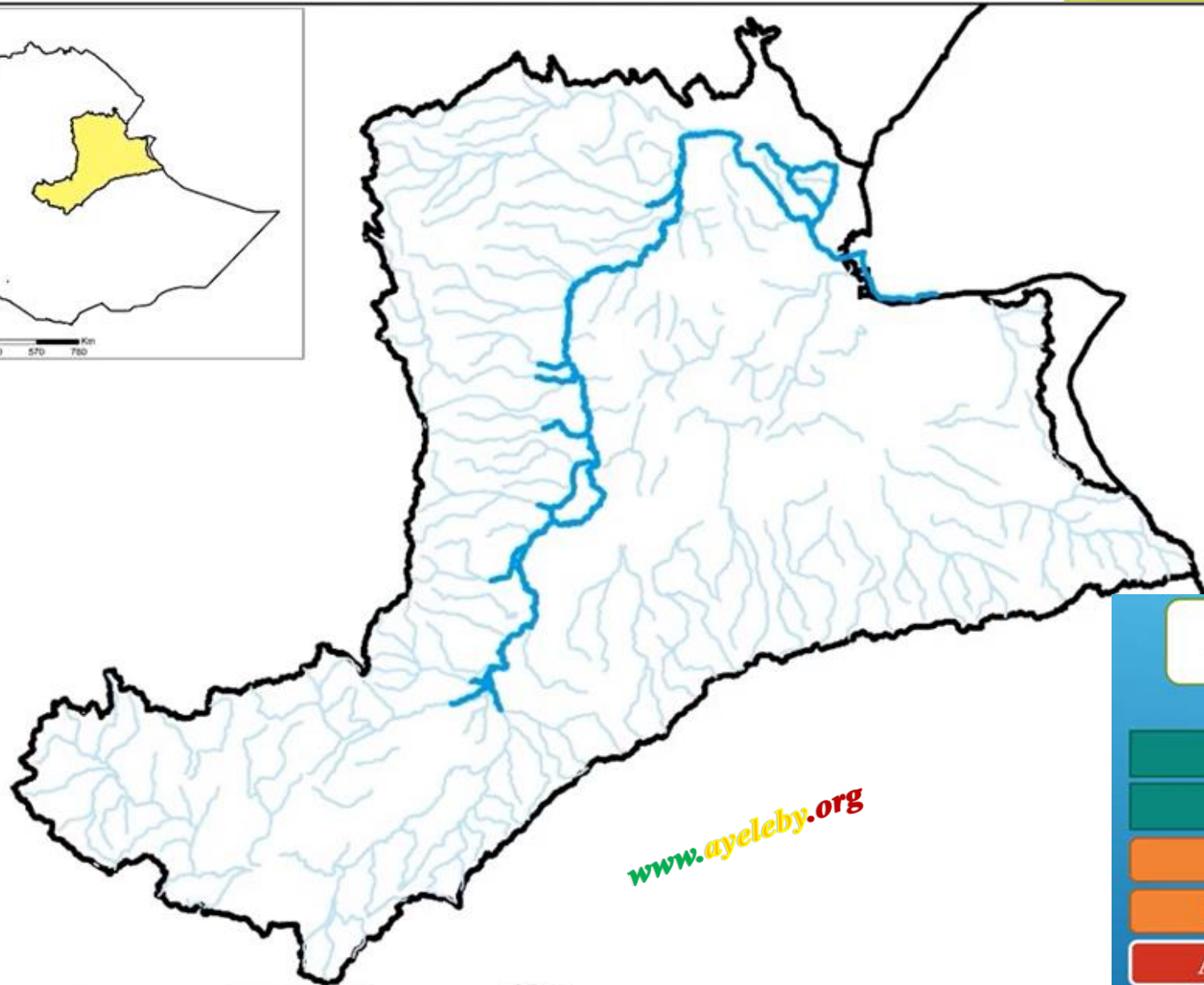
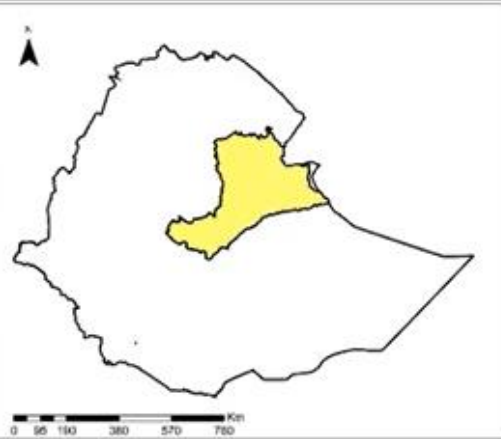
- ▶ The *Rift Valley drainage system* is an area of *small amount* of *rainfall*, *high evaporation* and *small catchment area*.
- ▶ The *size* of the *drainage area* is *restricted* by the *outward sloping highlands*, which *starts right* from the *edge* of the *escarpment*.
- ▶ The *Rift Valley drainage 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*.
- ▶ *Awash* river basin has a catchment area of *114,123* km² and has an average annual discharge of *4.9 billion cubic meters*.
- ▶ The *Awash* River *originates* from *Shewan plateau* in *central highlands of Ethiopia*, and flows *1250* kms.
- ▶ It covers parts of the *Amhara, Oromia, Afar, Somali, Dire Dawa*, and *Addis Ababa* City Administration.

- ▶ *Awash* is the *most utilized river* in the country.
- ▶ In the *Rift Valley drainage systems*, there is *no one general flow direction*, as the streams flow in all directions.
- ▶ Following the *Rift Valley orientation*, the *Awash flows* in a *northeast* direction.
- ▶ It finally *ends* in a *maze of small lakes* and *marshy area*; the *largest* of which is *Lake Abe* on the *Ethio-Djibouti* border.

- ▶ The *Afar drainage sub-basin* has practically *no stream flow*.
- ▶ It is an area of little rain, very high temperature and very high evaporation.
- ▶ *Lake Afrera* and *Asale* are the only main surface waters in the basin which are not the result of any meaningful surface flow.
- ▶ Their formation is related to tectonic activities.
- ▶ The *Southern part of the Rift Valley sub-basin* is characterized by a number of lakes and small streams.
- ▶ It is also described as *lakes region*.

- ▶ The lakes occupy *fault depression*.
- ▶ There are small streams that drain down from the nearby mountain slopes which supply water to the lakes.
- ▶ For example, *Meki* and *Katar Rivers flow* into *Ziway*; *Bilate* into *Abaya*; and *Segen* into *Chew Bahir*.
- ▶ Likewise, some of these *lakes are interconnected*.
- ▶ Lakes *Ziway* and *Langano* drain into Lake *Abijiata* through the small streams of *Bulbula* and *Horocolo* respectively.



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Awash

Source

Ginchi

Terminal

Lake Abhe

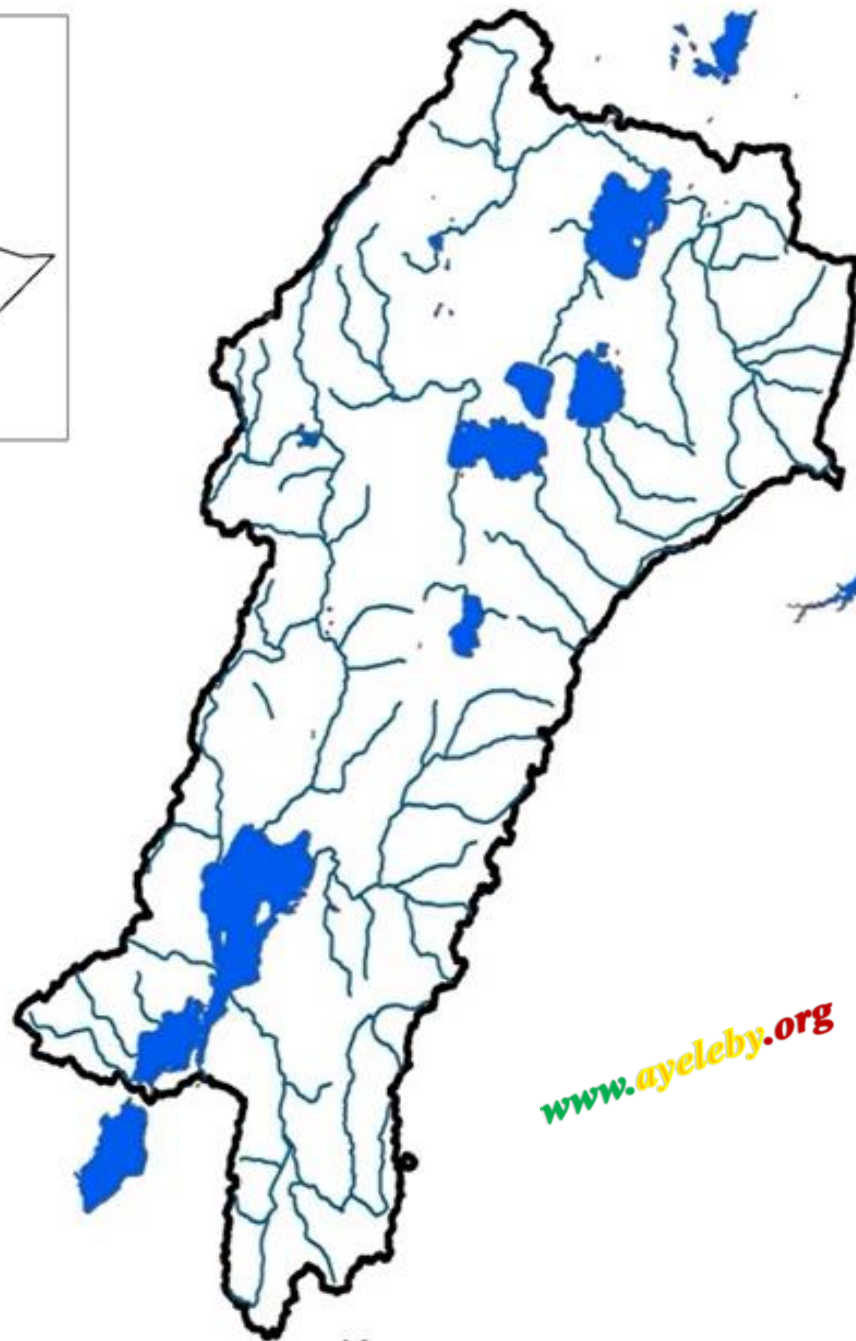
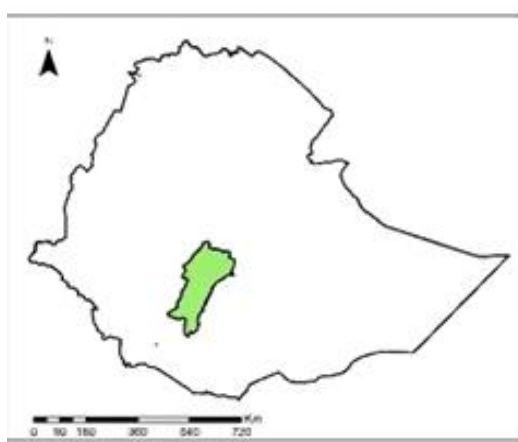
Area (km²)

114,123

Water Resource (BCM)

4.9

Image Credit : Abebe T. (HU. Inst. of Tech)



Rift Valley

Source

Arsi Mountains

Terminal

Rift Valley lakes

Area (km²)

32,150

Water Resource (BCM)

5.64

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0 25 50 100 150 200 Km

Image Credit : Abebe T. (HU. Inst. of Tech)

ETHIOPIA

Dessie

Djibouti

DJIBOUTI

L. Abbe

SOMALIA

*Ethiopian
Plateau*

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Dire Dawa

Awash

Ahmar Mts.

Addis Ababa

Germama

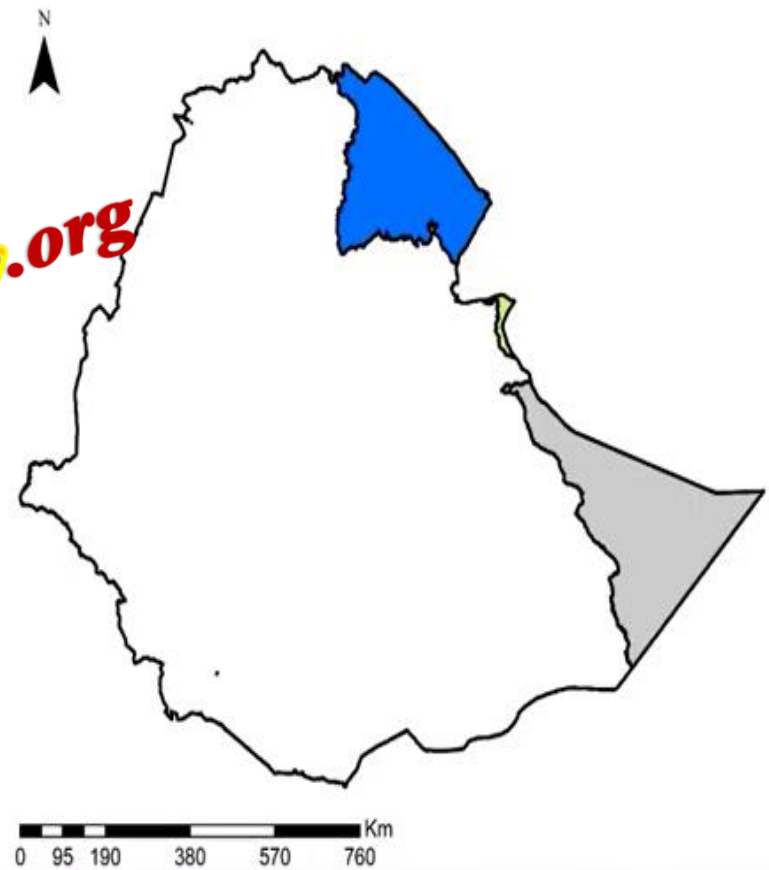
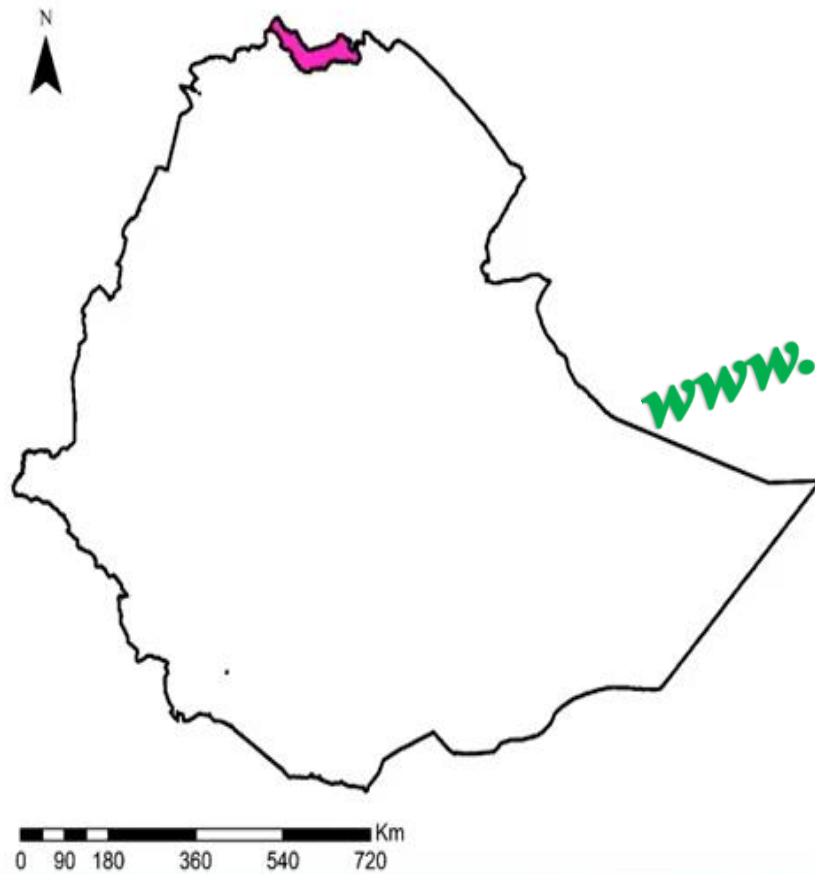
Adama

Koka Res.

L. Zway

0 25 50 100 Km





Source

Zalanbessa

Dinakle

Ogaden

Ayisha

Terminal

Eritrean Border

Kobar Sink

-

-

Area (km²)

6,014

65,918

87,751

2,256

Water Resource (BCM)

0.72

0.86

0

0

4.3. Water Resources: Rivers, Lakes and Sub-Surface Water

- ▶ *Why do majority of Ethiopian rivers end at seas and oceans?*

4.3.1. The Ethiopian Rivers

- ▶ *Unlike* many other *African countries*, 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*.

Table 4.1: Data on major Ethiopian rivers

River	Catchment Area(km ²)	Annual Volume BMC	Terminus/Mouth	Major tributaries
Abay	199,812	4.5	Mediterranean	Dabus, Dedessa, Fincha, Guder, Muger, Jema, Beshilo
Wabishebele	202,697	3.4	Coast of Indian Ocean	Ramis Erer, Daketa Fafan
Genale Dawa	171,042	6	Indian-Ocean	Dawa, Weyb, Welmel, Mena
Awash	114,123	4.9	Inland (within Ethiopia)	Akaki, Kesem, Borkena, Mile
Tekeze	87,733	8.2	Mediterranean	Goang, Angereb
Gibe (Omo)	79,000	16.6	Lake Turkana	Gojeb
Baro Akobo	75,912	23.23	Mediterranean	Akobo

Source: Compiled from different basin development master plans

By: Ayele B (Assi Prof)

General Characteristics of Ethiopian Rivers

- Owing to the *highland nature of the Ethiopian landmass, surface ruggedness*, the *outward inclination of the highlands*, and the *climatic conditions, Ethiopian rivers* have the following characteristics.
- ✚ Almost all *major rivers originate* from the *highlands* elevating *more than 1500* meters above sea level,
- ✚ *Majority of Ethiopian rivers* are *trans-boundary*,

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✚ *Due to the marked seasonality of rainfall, Ethiopian rivers are characterized by extreme seasonal fluctuation.*

✚ In the *wet season*, runoff is higher and rivers are full bursting their banks, destroying small bridges, damage roads and flooding low lands; during the *dry seasons* they became *mere trickles* of *water* or *even dry up*,

✚ Due to *surface ruggedness* they have *rapids* and *waterfalls* along their course,

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- ✚ 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.

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4.3.2. The Ethiopian Lakes

- *Why do majority of lakes in Ethiopia are clustered in rift valley system?*
- *We have lakes already dried and drying up. How do you think that happened?*
- Relatively Ethiopia is **rich in lakes**.
- Almost all **Ethiopian lakes** are result of **tectonic process** that took place during **Quaternary period** of **Cenozoic era**.
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- Except few Ethiopian lakes, **majority of lakes** are located within **the Rift Valley System**.

⇒ *Lake Tana*, the *largest lake in Ethiopia* (Table 4.2) occupies a *shallow depression* in the *highlands*.

⇒ The *Tana depression* is believed to be formed following *slower sinking* and *reservoir* by *lava flow* between *Gojjam* and *Gonder massifs*.

⇒ Ethiopia is also gifted with crater lakes. These include the lakes at and around *Bishoftu*, *Wonchi* (near Ambo), *Hayk* (near Dessie) and the *Crater Lake on top of Mount Zikwala*.

⇒ *Lake Ashenge* (Tigray) is formed on a *tectonic basin*.

⇒ Other types of lakes in Ethiopia are *man-made* such as *Lakes Koka*, *Fincha* and *Melka Wakena*, and many other lakes dammed following *hydroelectric power generation projects*.

Onebirr

Mount Ziquala

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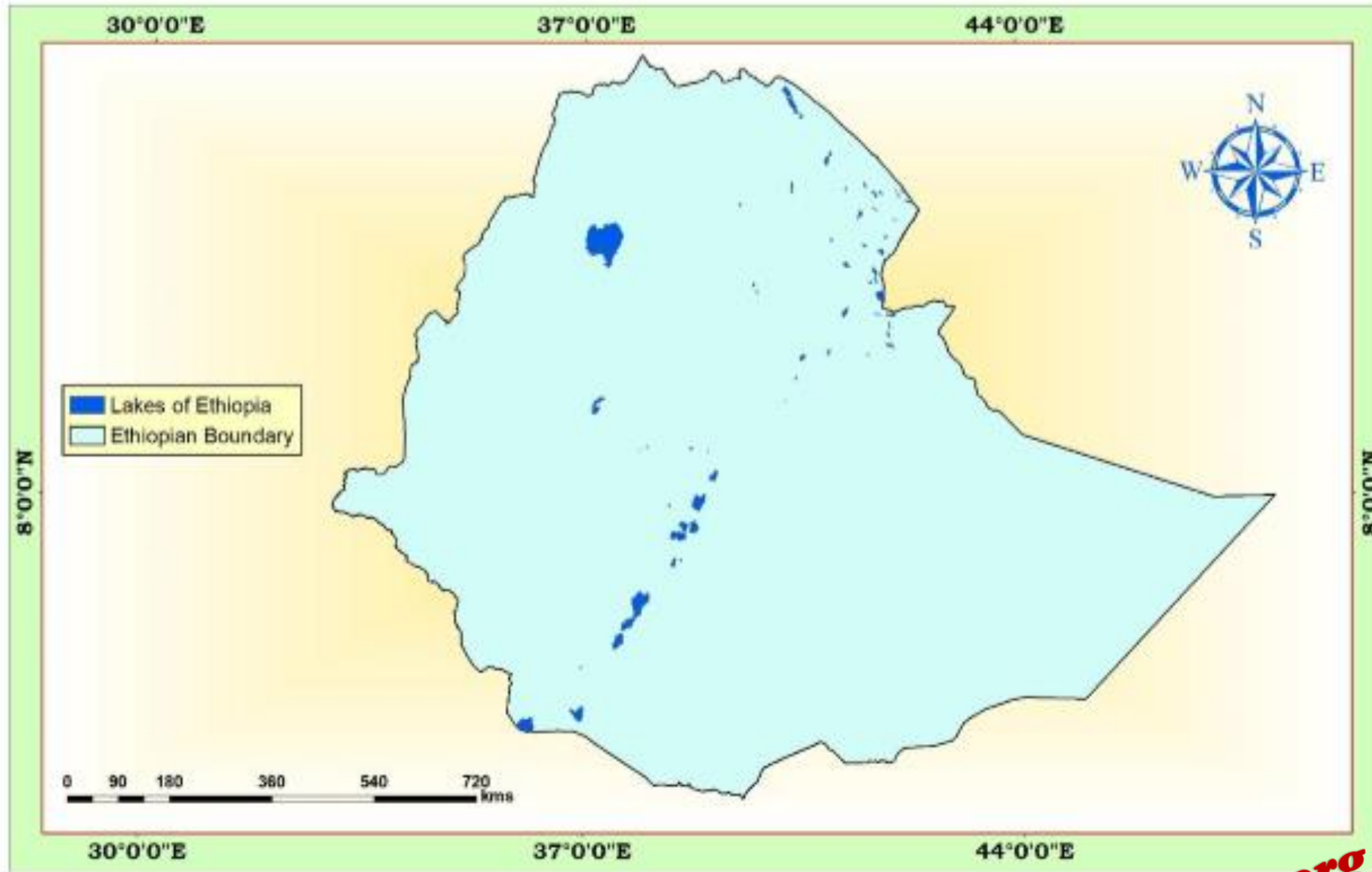
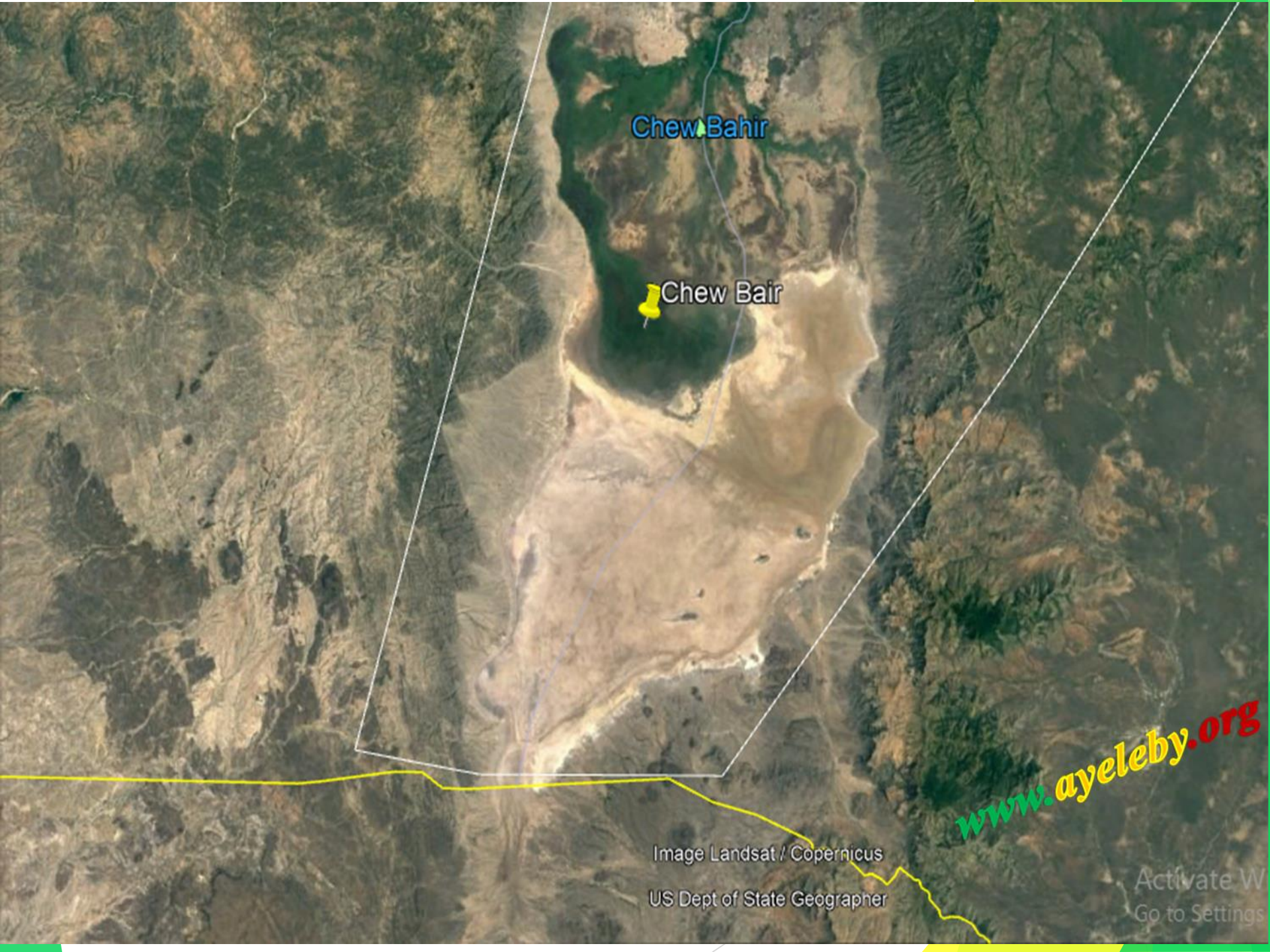


Figure 4.2. Lakes of Ethiopia

Source: CSA shapefile, 2012

- ▶ *Cluster of lakes* are *lined up* within *main Ethiopian rift*.
- ▶ *Lake Abaya* is the *largest* of *all the lakes* in the *system*.
- ▶ The *southern tip of the Rift Valley* forms the *marshy land* called the *Chew Bahir* which is drained by *Segan* and *Woito*.
- ▶ *Shala* and *Ziway* are the *shallowest* and the *deepest lakes* in the *central Ethiopian Rift* (Table 4.2).

A satellite map showing a large, irregularly shaped lake or wetland area in the center. The lake is surrounded by a mix of green vegetation and brown, dry-looking land. A white outline defines the lake's perimeter. Two labels, 'Chew Bahir' and 'Chew Bair', are placed near the lake. A yellow pushpin is stuck into the lake. A yellow line runs horizontally across the bottom of the map. The text 'www.ayeleby.org' is written in green and yellow in the bottom right corner. At the very bottom, there is small text about the image source and a watermark.

Chew Bahir

Chew Bair

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Image Landsat / Copernicus

US Dept of State Geographer

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Table 4.2: Area and depth of some of Ethiopian Lakes

Lake	Area (km ²)	Max. Depth(m)	Lake	Area (km ²)	Max. Depth(m)
Tana	3600	9	Abijata	205	14
Abaya	1162	13.1	Awassa	129	10
Chamo	551	13	Ashenge	20	25
Ziway	442	8.95	Hayk	5	23
Shala	409	266*	Beseka	48.5	11
Koka	205	9			

Source: Compiled from different sources

4.3.3. 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 www.ayeleby.org conditions determine *availability 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*.

4.4. Water Resources Potentials and Development in Ethiopia

- ▶ *The potential of exploitable water in Ethiopia is huge, so why is our agriculture still rain-fed?*
- ▶ *What do you think are reasons that diminish the irrelevance of Ethiopian rivers for transportation?*
- ⇒ The enormous *water resource potential* of Ethiopia is *underutilized* due to so many factors.
- ⇒ However, there are *plenteous of opportunities* that *can transform* the *resource* into *our collective social and economic needs*.
- ⇒ The followings are some of *potential development uses of water resource of Ethiopia*.

a) Hydro-electric Potential

- ⇒ Ethiopian rivers have a *very high potential for generating electricity*.
- ⇒ The exploitable potential of *hydroelectric power* is estimated at about *45000 megawatts*.
- ⇒ The *first hydroelectric power generation plant* was *installed* on *Akaki River (Aba Samuel)* in *1932*.
- ⇒ Currently *many hydroelectric power dams* are *operating* and *many* others are *under construction* to realize *Ethiopia's ambitious energy goals*.

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- *Gilgel Gibe III* hydropower project has gone operational generating 1870 megawatts.



⇒Currently Ethiopia is *administering 14 hydroelectric power plants* constructed on *Lake Aba Samuel, Koka, Tis Abay, Awash, Melka Wakena, Sor, Fincha, Gibe/Omo, Tana Beles* and *Tekeze*, generating close to 4000 megawatts of energy.





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- ⇒ Besides the *domestic use of generated electricity*, the *country is exporting electricity* to the *neighboring countries*.
- ⇒ The major problem related to the *use of Ethiopian rivers* for the *generation of hydroelectric power* is the *seasonal flow fluctuations* and *impact of climate change and variabilities*.
- ⇒ The *severe erosion from the highlands* and *sedimentation* in the *reservoirs* is also a *critical problem* for *hydroelectric power generation*.

b) 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*.
- ⇒ Regardless of *existing physiographic setups*, *Ethiopia's potential of irrigation is estimated to be 5.3 million hectares*.

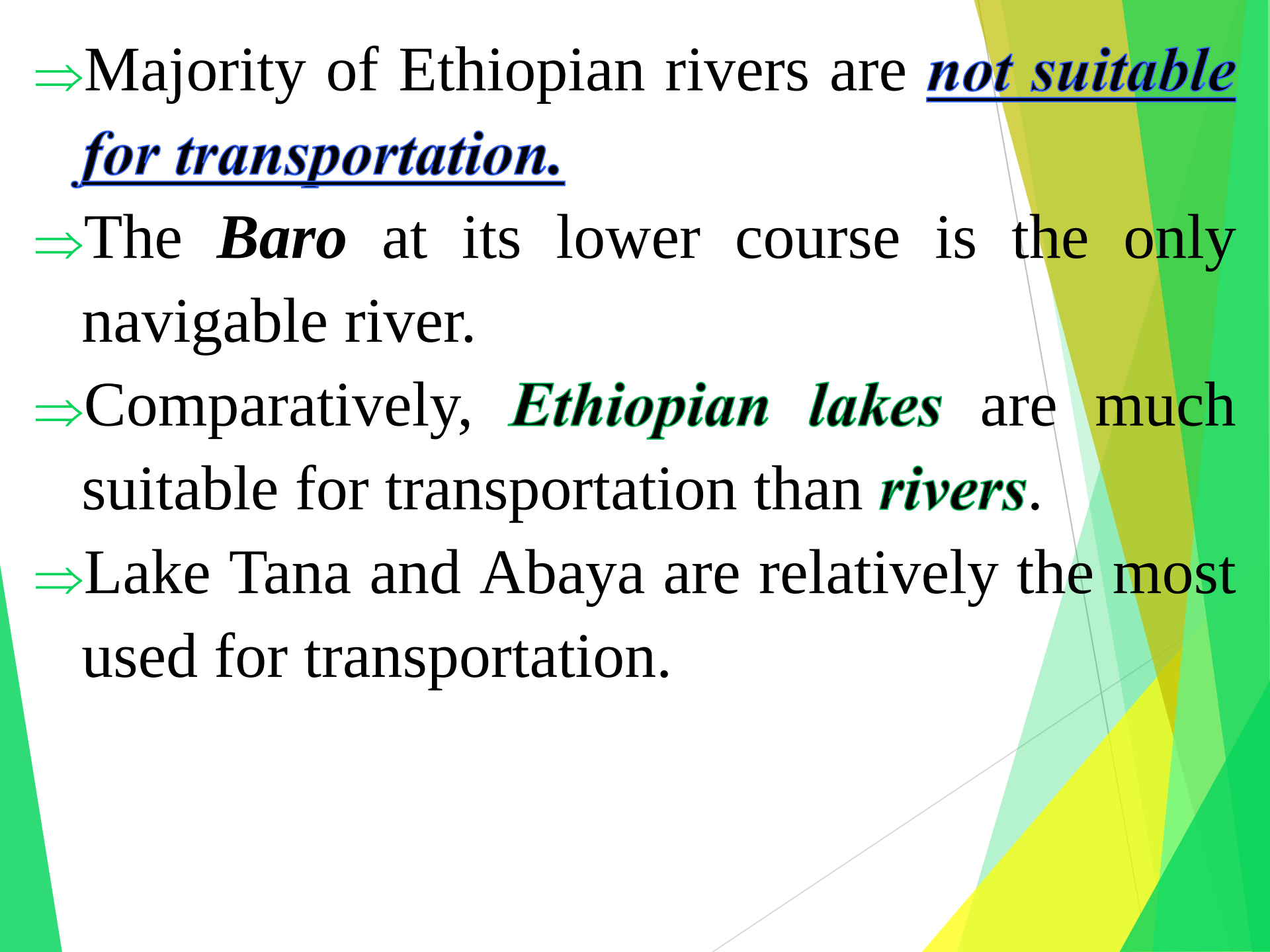


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Irrigation and Drainage Design

- ⇒ The *Baro-Akobo* and *Genale Dawa* river systems have *large irrigation potential* compared to other basins.
- ⇒ Despite the untapped irrigation practice, *more than 60%* of the *area under irrigation* so far is located in *Rift Valley Drainage System*.
- ⇒ Except few, majority of *hydro-electric reservoirs* are *multi-purpose* and are expected to contribute for irrigation.

- 
- ⇒ Majority of Ethiopian rivers are *not suitable for transportation.*
 - ⇒ 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.

c) Fishing and Recreation

- ⇒ The *majority of Ethiopian lakes* are *rich in fish*.
- ⇒ Currently the *annual production of fish* is estimated to be *31.5 thousand tons*.
- ⇒ The *exploitable potential* is however, by *far greater than the current production*.
- ⇒ *Exploitable fish potential* in *lakes varies*.
- ⇒ Currently *Lake Tana* leads the potential by estimated *8,000-10,000 tons per year*.
- ⇒ Fish production from *Lake Chamo* is estimated at *4,500 tons per year*.
- ⇒ However, *more than 60% of fish supplies* are coming from *Ethiopian main Rift Valley lakes*.



- ⇒ However, *some of the lakes* are currently *threatened by sedimentation, invasive species (water hyacinth), over exploitation* and *expansion* of *investments around lakes*.
- ⇒ There are a variety of fish, birds and other aquatic life forms in the lakes.
- ⇒ This and the *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*.
- ⇒ As they are the natural habitat of a variety of wild life, some of which are only endemic to Ethiopia, their value for scientific purposes is immense.

Review questions

1. Discuss the major drainage systems of Ethiopia.
2. Explain the hydroelectric and fishing potential of Ethiopian water resource
3. State the major characteristics of Ethiopian rivers?
4. How do you justify the origin and flow direction of Ethiopian rivers in each drainage basins?