Rivers in arid lands: 2040 water supply and demand

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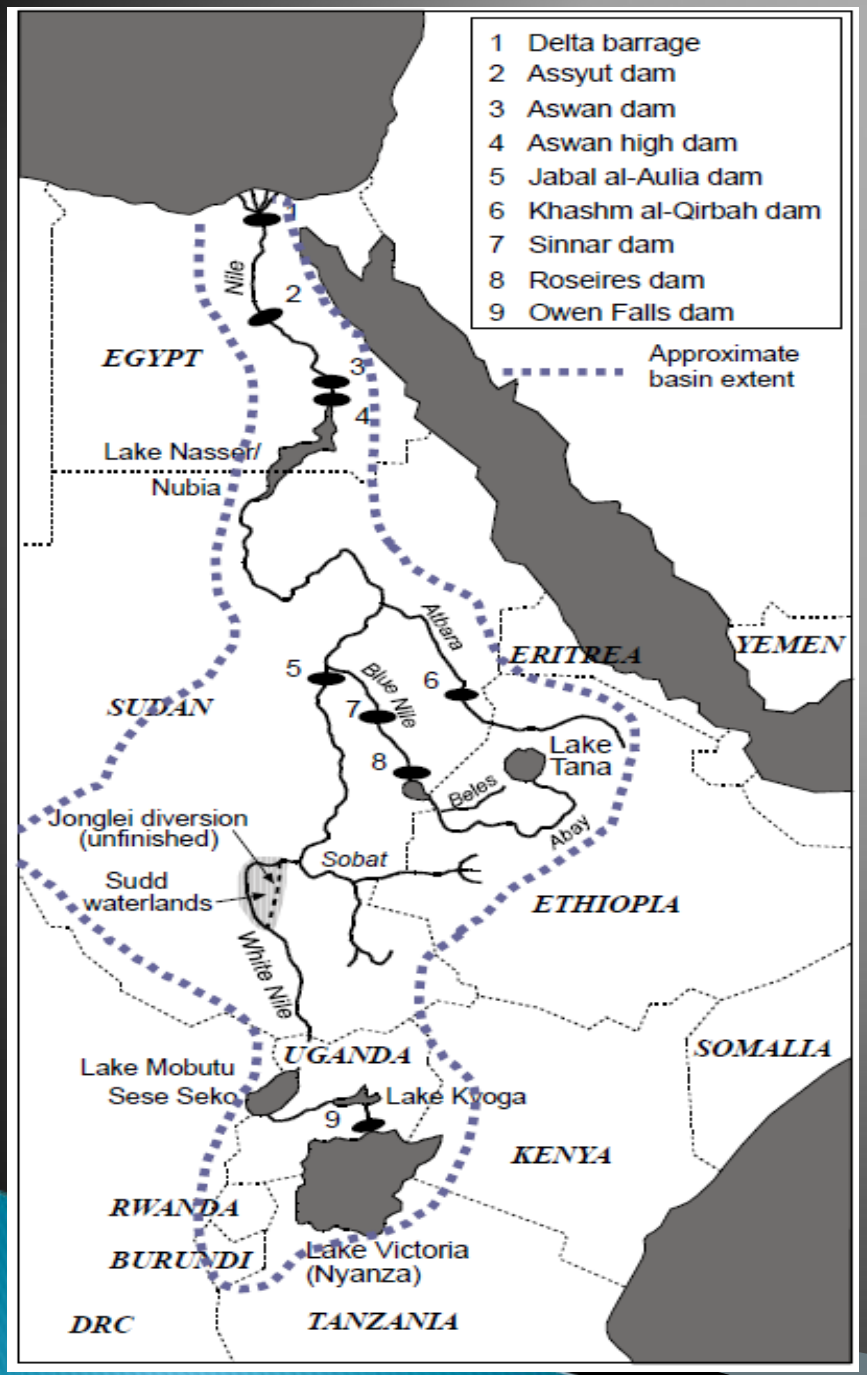
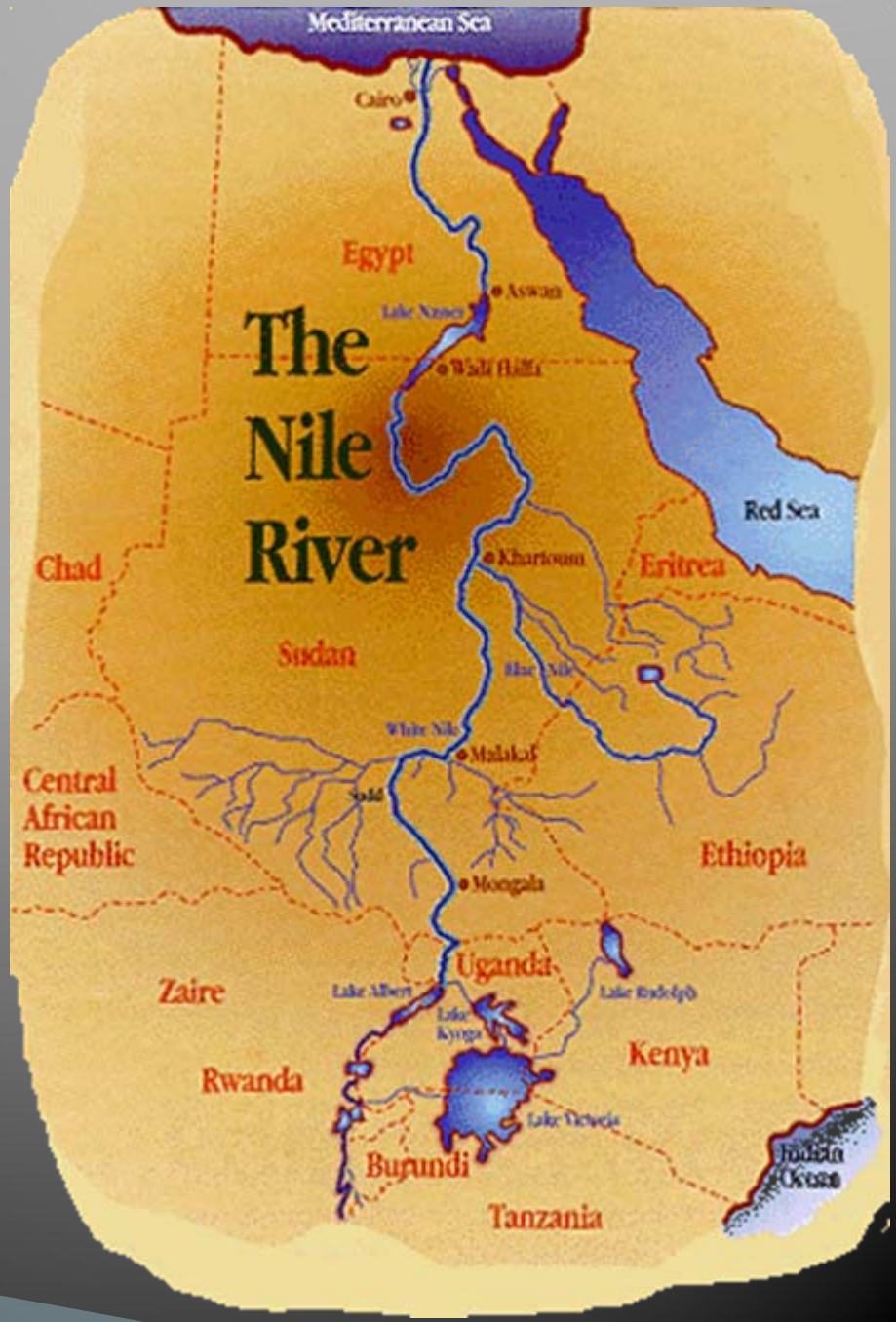
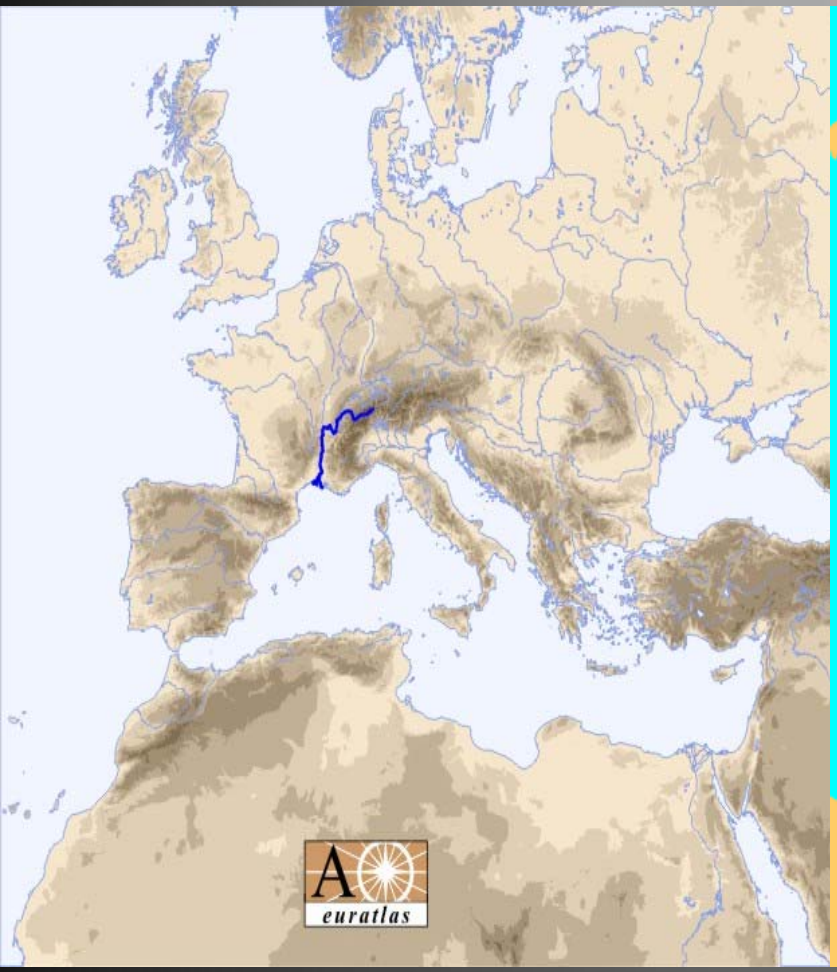
Euphrates
Tigris


Barrage de Kiban
B. de Karakaya
B. de Kralkizi
B. de Dicle
Barrage de Silvan
B. de Batman
Lac de Van
Barrage de Dengecidi
Barrage de Adiyaman
B. de Kahta
B. de Hasankeyf
B. de Birecik
Barrage Atatürk
Tunnels de Sanliurfa
Turquie
Barrage d'Ilisu
Barrage de Cizre
B. de Karkamis
B. de Suruc
Barrage de Kigarik
Barrage de Hasankeh Est
Barrage de Hasankeh Ouest
Barrage Saddam
Barrage de Tichrin
Barrage al-Assad
Syrie
Barrage de Tabqa
Barrage al-Baath
Euphrate
Khabour
Irak
0
100 km


1 Delta barrage
2 Assyut dam
3 Aswan dam
4 Aswan high dam
5 Jabal al-Aulia dam
6 Khashm al-Qirbah dam
7 Sinnar dam
8 Roseires dam
9 Owen Falls dam
Approximate basin extent
Nile
EGYPT
Lake Nasser/ Nubia
Atbara
Blue Nile
ERITREA
YEMEN
SUDAN
Lake Tana
Beles
Abay
Jonglei diversion (unfinished)
Sobat
Sudd waterlands
ETHIOPIA
White Nile
UGANDA
SOMALIA
Lake Mobutu
Sese Seko
Lake Kyoga
KENYA
RWANDA
BURUNDI
Lake Victoria (Nyanza)
DRC
TANZANIA


Mediterranean Sea
Cairo
Egypt
Aswan
Lake Nasser
Wadi Halfa
The Nile River
Red Sea
Chad
Khartoum
Eritrea
Sudan
Blue Nile
White Nile
Malakal
Central African Republic
Ethiopia
Mongala
Uganda
Zaire
Lake Albert
Lake Kyoga
Kenya
Rwanda
Lake Victoria
Burundi
Tanzania
Indian Ocean


CANTÁBRICO
FRANCIA
ANDORRA
MEDITERRÁNEO
NELA
JEREA
EMBALSE DEL EBRO
BAYAS
ZADOYA
ARGA
IRATI
EGA
YESA
LAIRUZA
OCA
TIRÓN
ARAGÓN
BUBAL
ARA
ESERA
DE LA PEÑA
MEDIANO
NAJERILLA
NAVAS
TREMP
NOGUERA RIBAGORZANA
NOGUERA PALLARESA
IREGUA
CIDACOS
ARDISA
SOTÓN
ELGRADO
J. COSTA
TERRADETS
MAIRILLA
LINARES
ALHAMA
ARBA
SOTONERA
BARASONA
CANELLES
CAMARASA
GÁLLEGO
CINCA
Sª ANA
SEGRE
S. LORENZO
AÑAMAZA
JALÓN
HUERVA
EBRO
MEQUINENZA
MEZALOCHA
RIBARROJA
LA TRANQUERA
MARTÍN
FLIX
JILOCA
LAS TORCAS
MESA
ORTIZ
PIEDRA
CUEVA FORADADA
GUADALOPE
MATARRAÑA
SANTOLEA
BERGANTES
CUENCA DEL EBRO
Escala
0 10 20 30 40 50
NORTE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UNITED KINGDOM
BELGIUM
GERMANY
English Channel
LUXEMBOURG
Etretat
Caudebec
Les Andelys
Seine River
Honfleur
Giverny
Vernon
Versailles
Paris
Beaune
Chalon-sur-Saone
Saone River
SWITZERLAND
Tournus
Macon
FRANCE
Trevoux
Rhone River
Lyon
Bay of Biscay
Tournon
Vienne
ITALY
Viviers
N
Chateauneuf du Pape
Avignon
Arles
SPAIN
Mediterranean Sea


COLORADO
NEW MEXICO
UNITED STATES
Dallas
Odessa
TEXAS
Ciudad Juárez
El Paso
Río Grande
Pecos
CHIHUAHUA
San Antonio
Ciudad Acuña
Eagle Pass
Piedras Negras
Laredo
COAHUILA
Corpus Christi
Brownsville
Matamoros
Monterrey
Torreón
DURANGO
MEXICO
NUEVO LEON
TAMAULIPAS

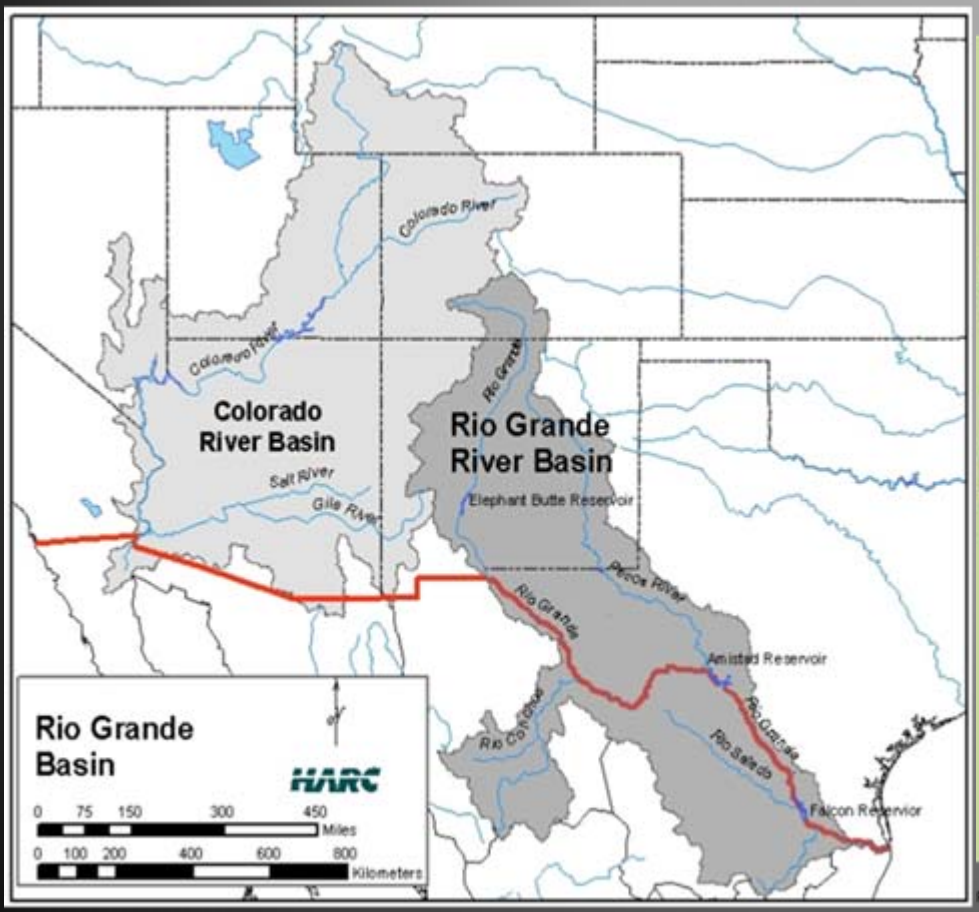


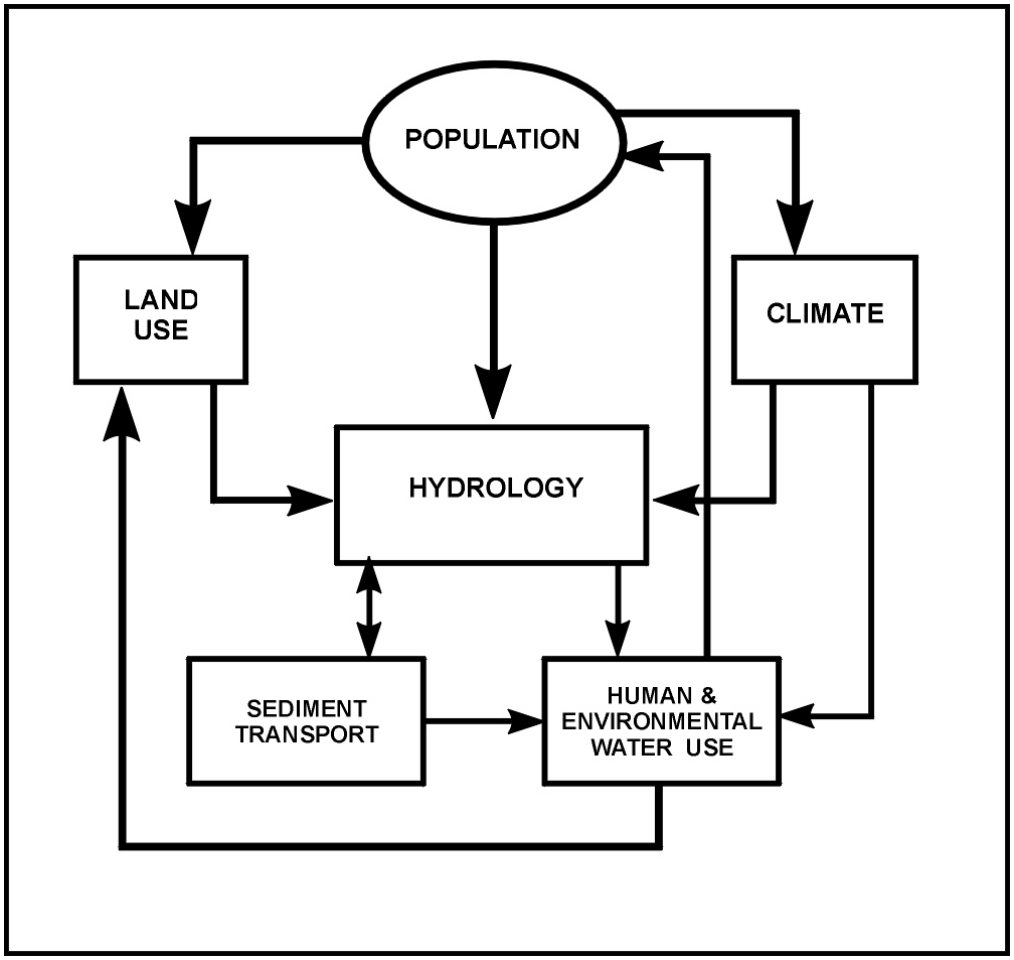
Figure 2 Colorado and Rio Grande Basins

Figure 1 Rio Grande Dams and Diversions

Common Features/Challenges

- Main water supply from winter precipitation/snowpack
- Multiple dams and diversions
- Irrigated agriculture in arid downstream basin
- Environmental damage
- Competition among countries/states
- Impact of climate change
- Storage loss from sedimentation
- Land use and population growth
- Instream flow/water quality
- Foresight capacity

Water budget



Results

- Sedimentation: Storage loss of 5 percent/decade
- Climate change: < 10 percent/decade
- In stream flow: irregular and declining
- Land use: slow decline of irrigated land
- Population growth: will double in 30 years

Results (ct'd)

- 30 to 40 Percent less water by 2040
- Cities will need larger share
- Agriculture can do more with less
- Ecological damage will increase

- *Food security: yes*
- *Sustainable development: no*