The Future of Arid Land Agriculture: The Aral Sea Basin of Central Asia and the San Joaquin-Tulare Basin of CA.

Waterscape International Group

Purpose-Why Look at the Aral?

- Compare the Aral Sea Basin to Tulare Basin
- Learn a bit about arid land, irrigated agriculture
- Provide California with a “window into the future”
- Informational presentation

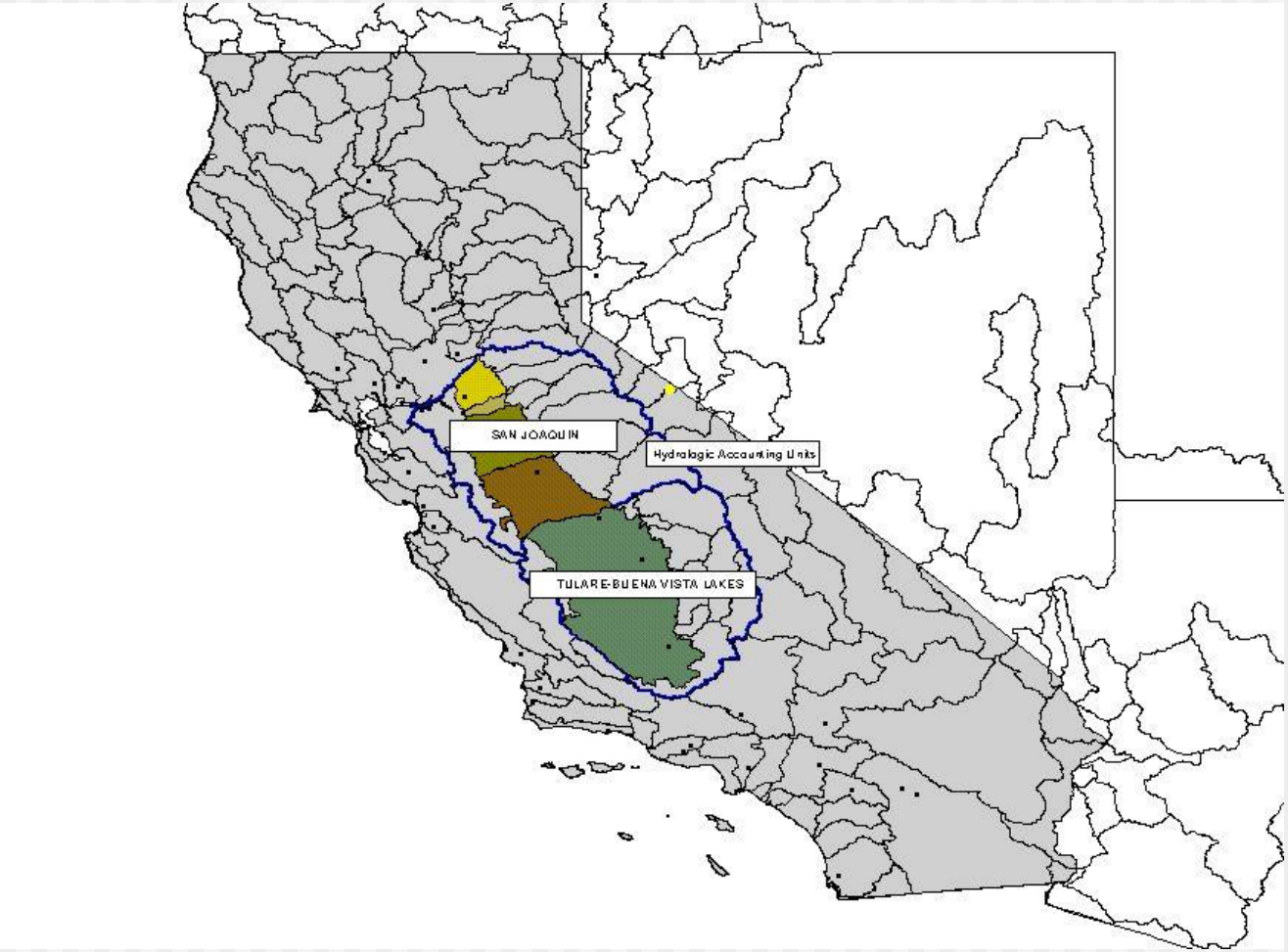
Conversions

- 1 sq. km = 100 hectares
- 1 hectare = 2.5 acres
- 1 sq. mile = 640 acres = 259 hectares
- 1 acre-foot = 1230 cubic meters
- 1 cubic km = 813,000 acre-feet

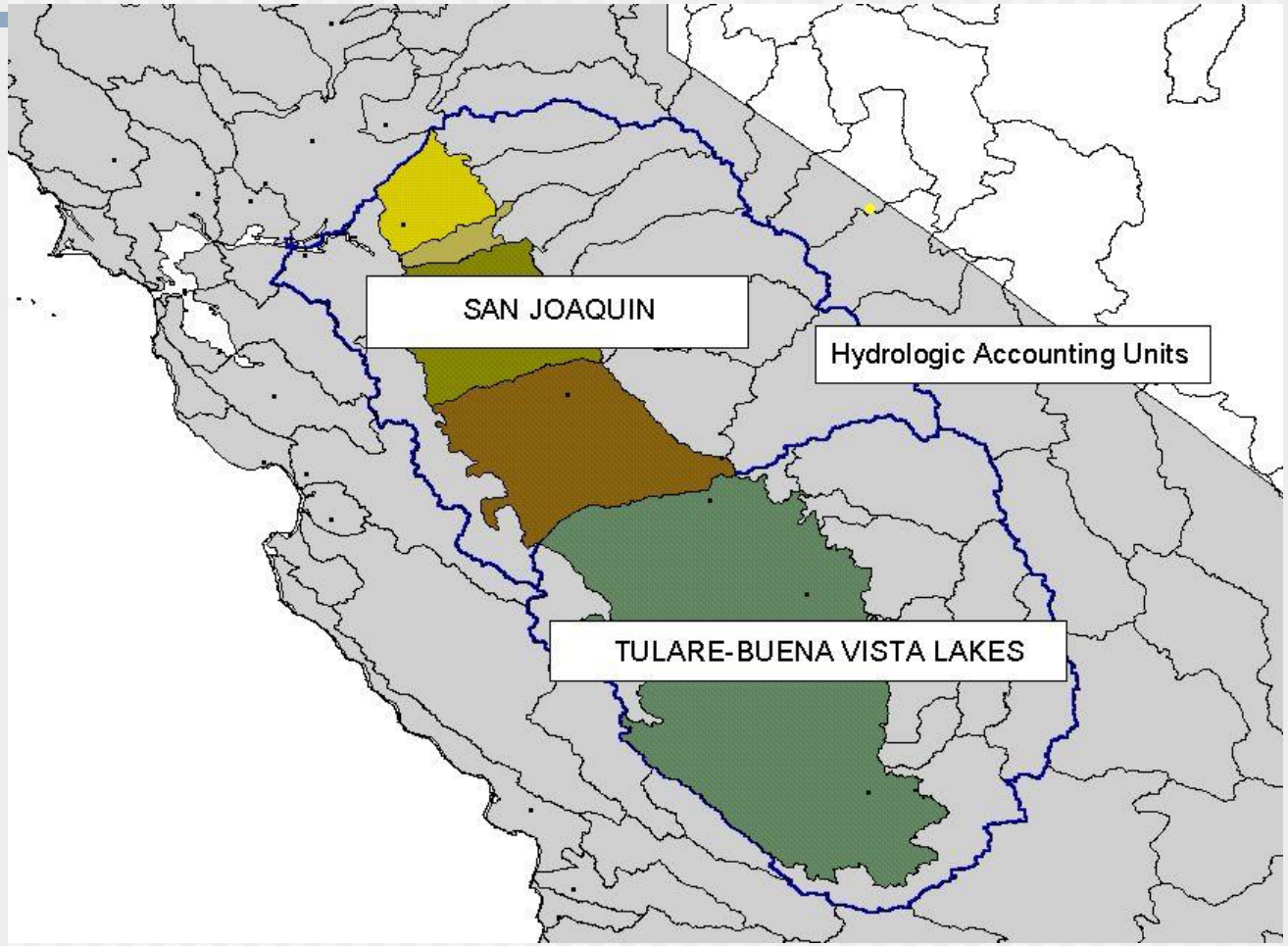
Features of SJ & Tulare Basins

- Southern Half of the Central Valley
- 84,000 sq km
- Sacramento to Bakersfield
- Sierras, Coast Ranges, Tehachapi, Delta
- Silicate-rich Sierran Sands, Coast Range Alluvium Flood Basin Deposits

Map of SJ Tulare Basins



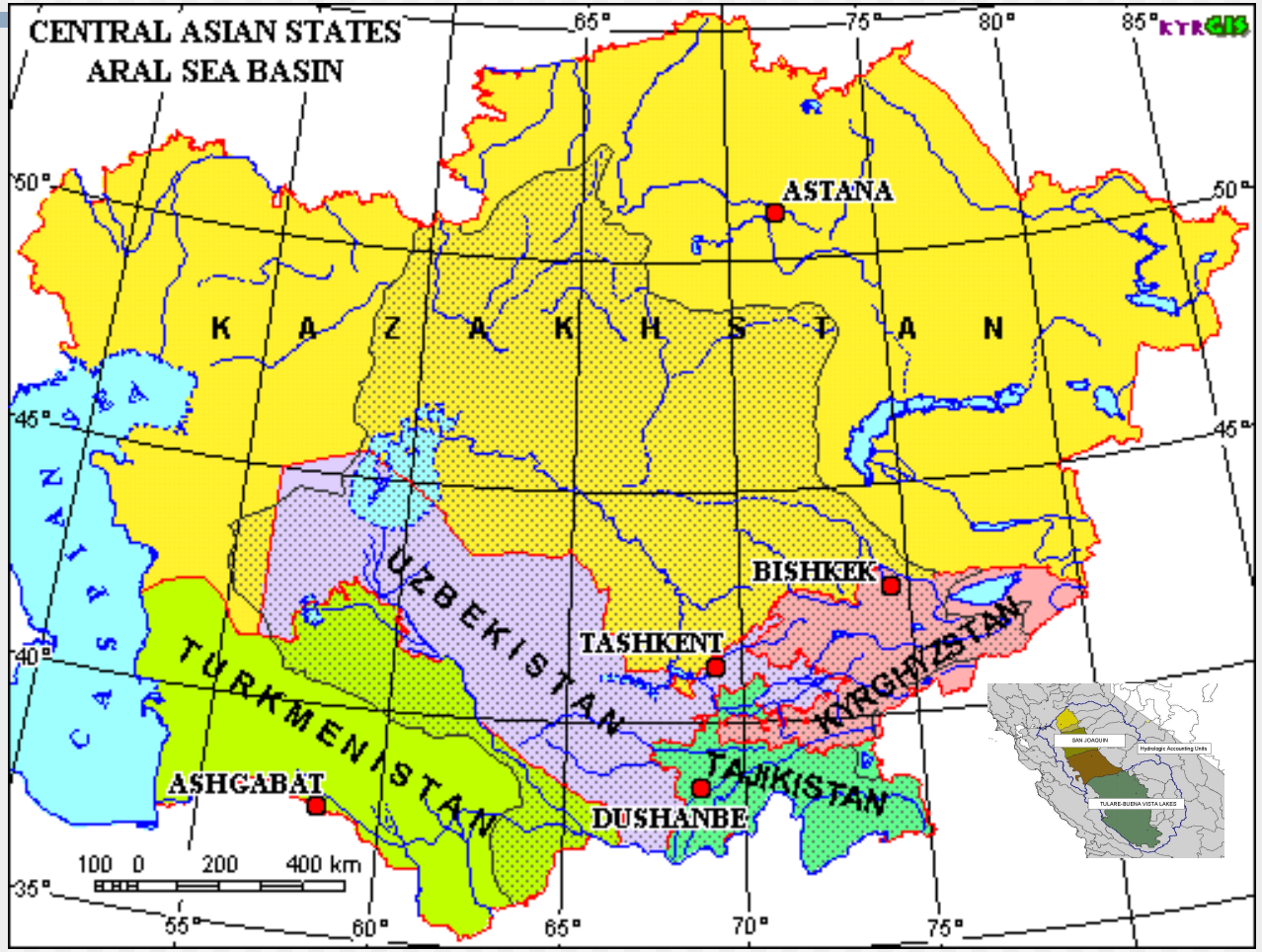
Close-up View



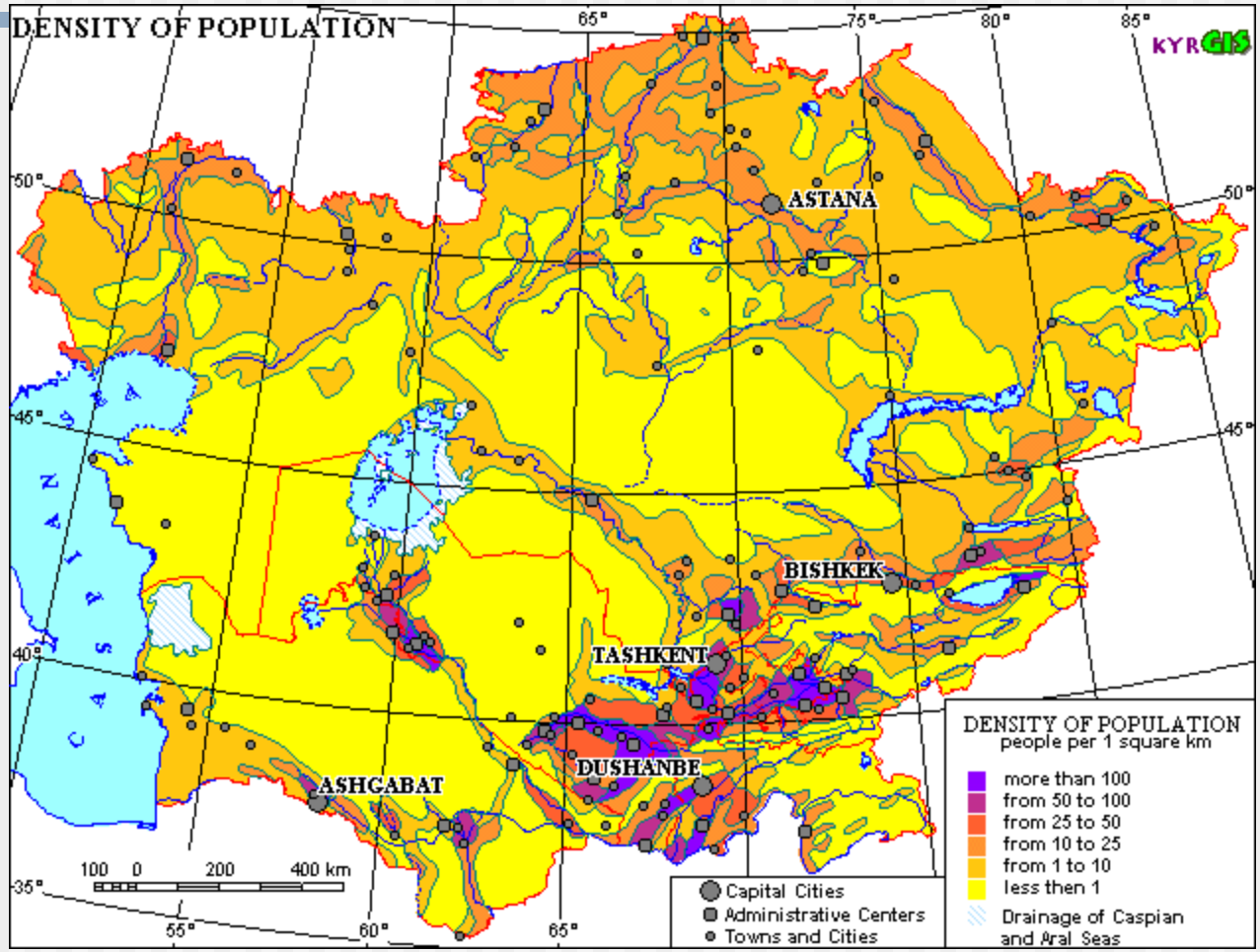
Features of Aral Sea Basin

- 3,995,900 thousand sq.km. (all of Central Asia)
- 53,017 thousand people

Map of Aral Sea Basin



Aral Sea Basin-Population



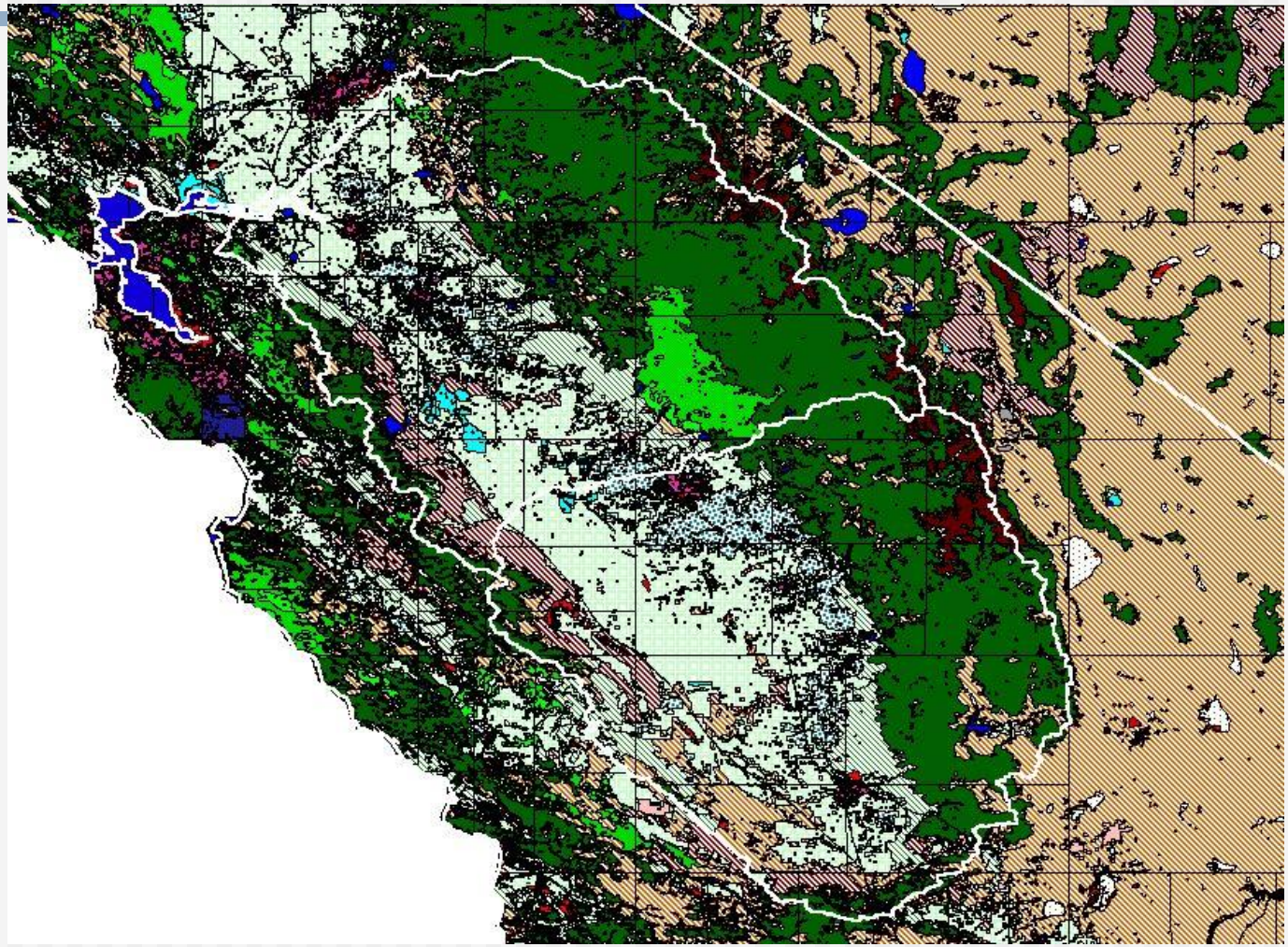
Land/Water Use in the SJTB

- 5-7 million irrigated acres (2-3 million hectares)
- Diverse range of agricultural activities, grazing
- Liberal pesticide/fertilizer application
- Water Usage groundwater: 7 million acre-feet
- Recharge = 5 million acre feet
- Surface Water Usage (8 million acre-feet)
- 70% for agriculture

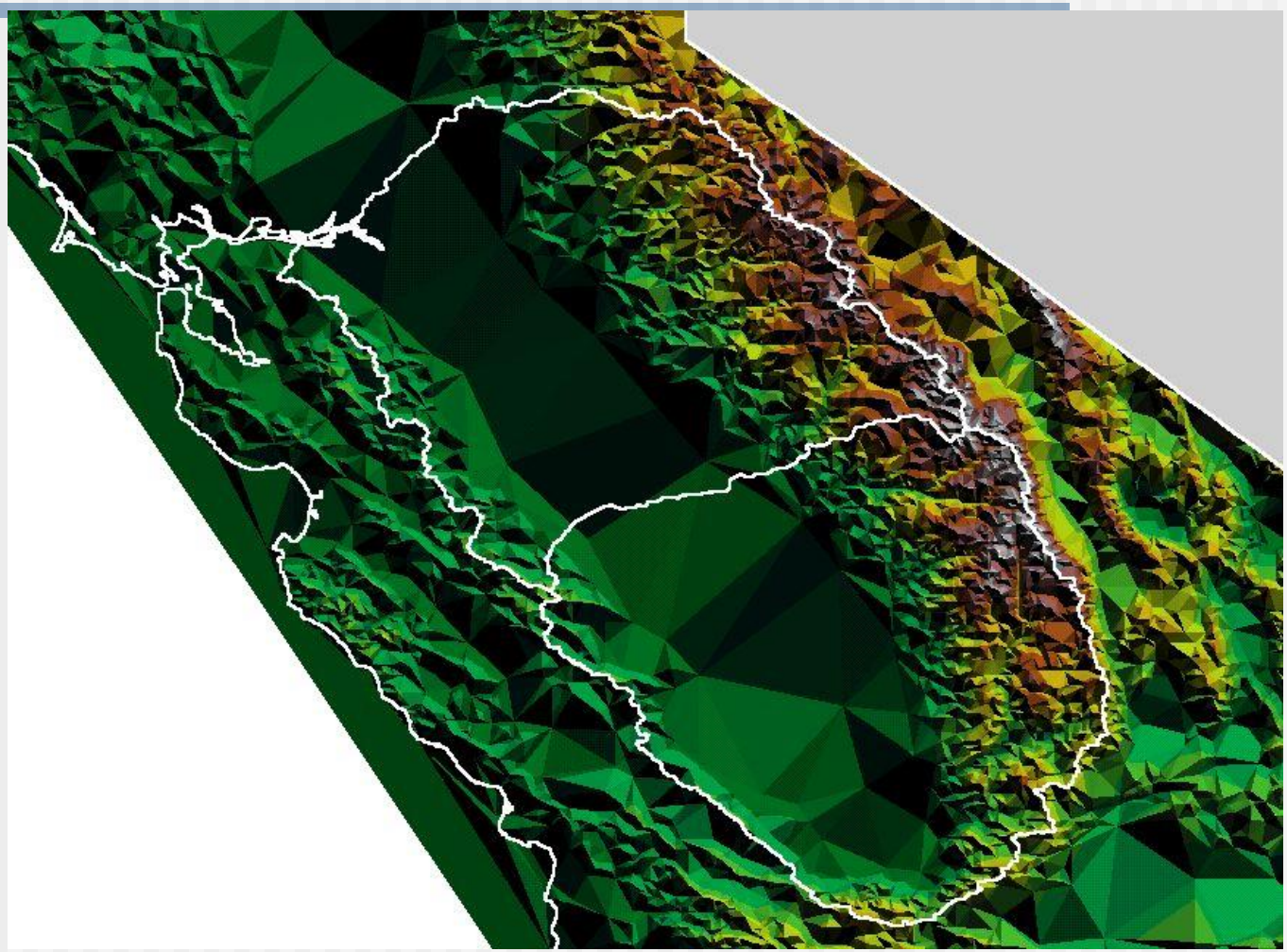
Land/Water Use in Aral

- Total Mean Surface Water Flow = 116 cubic km (60 into Aral Sea)
- Annual Usage >95%
- Groundwater Reserves ~31 cubic km
- Annual Usage = 10 cubic km
- Cotton & Grain 75%
- Irrigated lands have doubled (7.5-7.9 million hectares).
- Total Cultivated 10 million hectares
- Agriculture in the region dates back to the 6th-7th centuries B.C

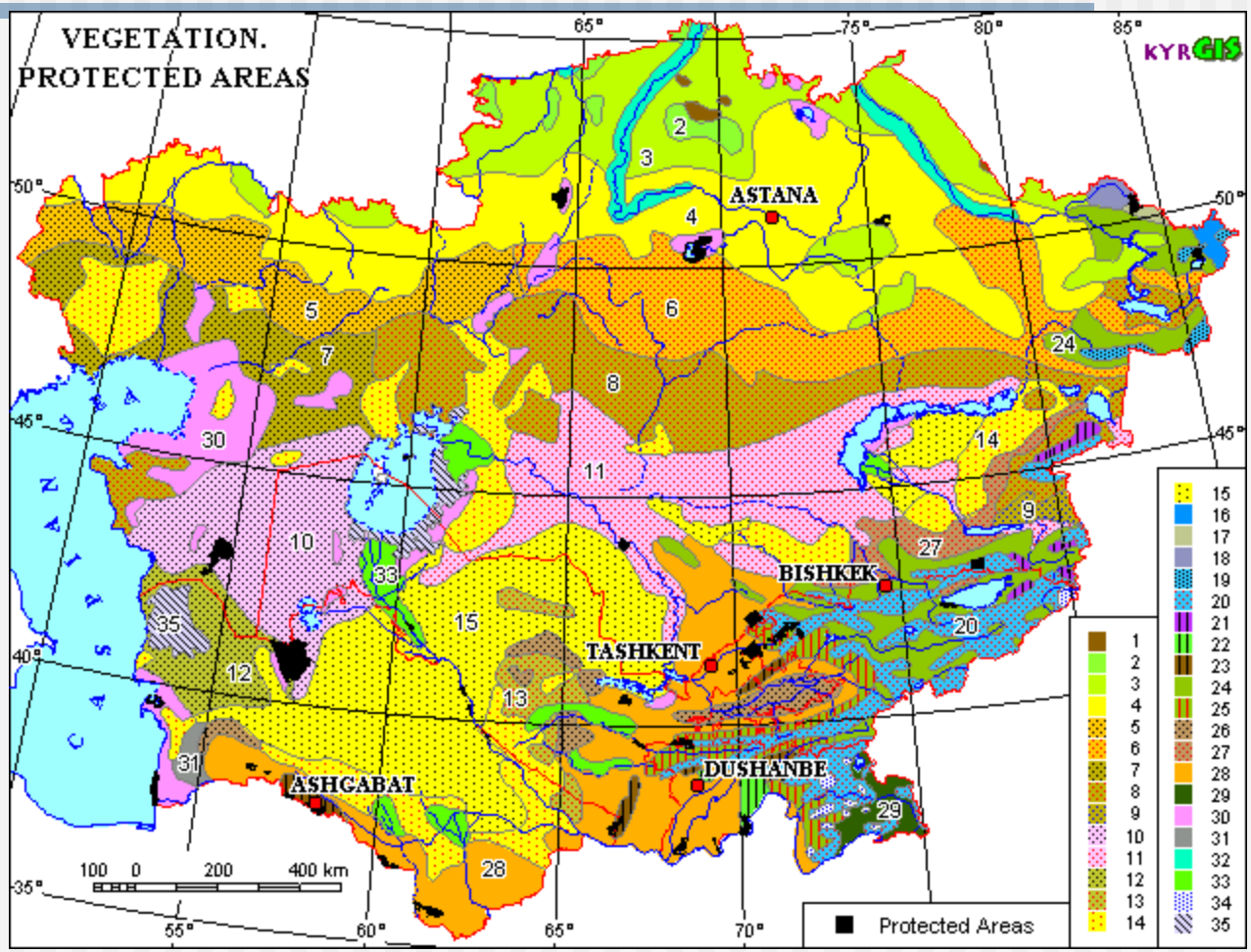
SJ Tulare Basin-Land Cover



SJ Tulare Basin - DEM



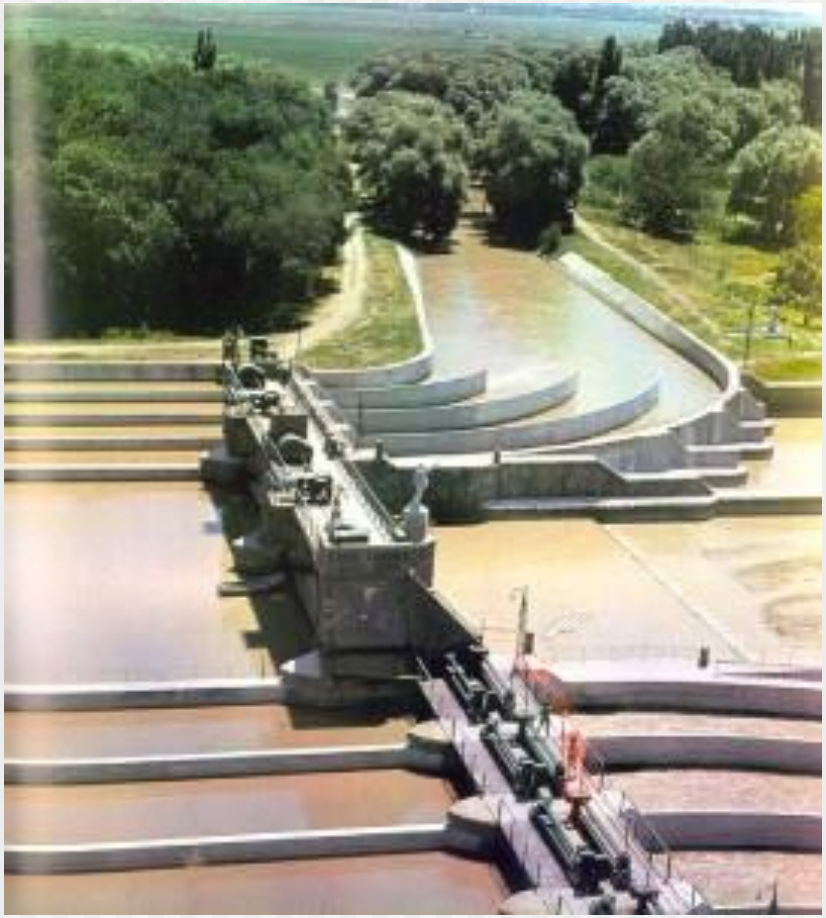
Aral Sea Basin-Land Cover



Drainage Irrigation

- Type of agriculture
- One big evaporation dish
- Irrigation (>90% furrow irrigation)
- Drainage (Aral Sea Basin installed drainage late)
- What to do with the drainage?

Irrigation Canals



Impact of Arid Land Agriculture

- Salinization
- Trace Elements
- Pesticides
- Nutrients
- Reduced Runoff

Effect on SJ Tulare Basin

- NAWQA facts
- Decline in Ag. Productivity
- Drinking water (ground and surface) quality and availability declines
- In-stream use impact

Effect on Aral Sea Basin

- Decline in agricultural productivity (salinization and trace elements)
- Decline in drinking water quality (pesticides, fertilizers, salt)
- Air quality
- Decline in drinking water quantity (diversions, pumpage)
- Reduction in the sea dimensions
- Increase in evaporation and drainage-collecting water, water salinity considerably increased from 9.94 g/litre in 1965, to about 15 g/litre in 1996

Effect on Aral Sea Basin (cont.)

- Salinized Land in Uzbekistan
  1982: 12,000 sq. km 1985: 16,430 sq. km
- Inflow to Aral Sea
  Historic: 56 cub km 1966-70: 47 cub km 1981-85: 2 cub km

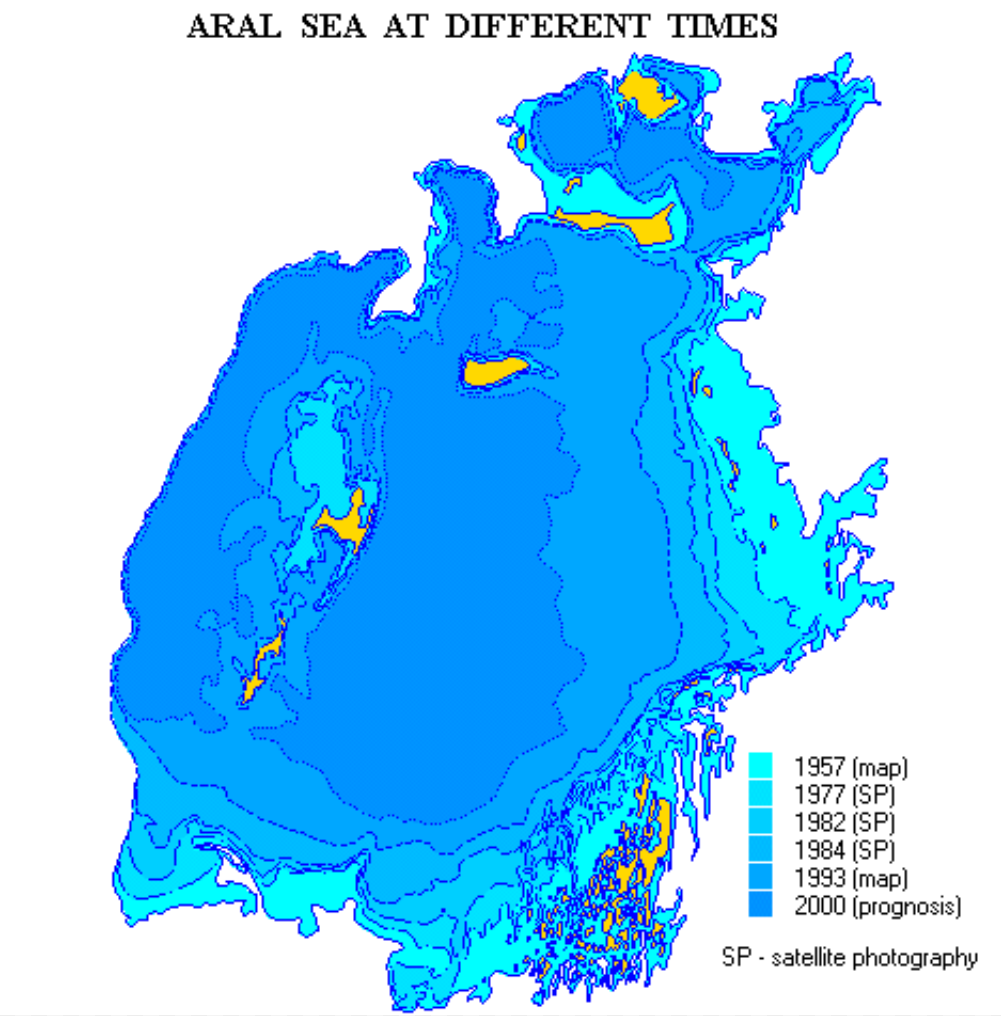
Fish Catch from Maly Aral

Year	1991	1992	1993	1994	1995	1996	1997
Total	3680	2539	2163	1519	570	471	805

Metric Tons

All 24 species of native fish have died off.

Aral Sea Surface Area Change



Abandoned Fishing Boats

Public Health Dimension

- Study of 700,000 women in Karakalpakstan
  97% anemic (manganese and zinc)
- Kidney and Liver Disease

What's being done?

SJTB

- CVPIA, CALFED
- 303 (d) CWA Listings
- TMDLs
- DWSAP Program
- CAA Suit

Aral Sea Basin

- World Bank
- Funding is a large issue

The Upshot

- Exploiting agricultural productivity over a very shot period of time.
- Permanently impairing your groundwater and surface water as a drinking water source
- Permanently devegetating the landscape
- Negatively influencing public health through air, soil, and water quality
- Destroying fisheries and natural habitat

Enough, In-time?

- Stop drainage, gw contamination?
- Regrowth of natural vegetative cover? Bare soil evaporation.
- What can be done?
- Line canals, better drainage, etc?

Lessons Learned

- How has this happened?
- Why?
- Can the problems of the Aral Sea Basin manifest themselves in California?
- How can the course be altered today?
- How can this course be prevented in the future?

References

- National report: "On the environment state and use of natural resources in the Republic of Uzbekistan". State Committee on Nature protection of Uzbekistan. Tashkent, 1998.
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- Ministerial conference of the Central Asia. "Assessment of the environment". Aarhus, Denmark, 1998.
- **J.Mahambetova.** *"Non-government union "Aral tenizi". Aralsk, 1999.*