

Human Driving Force

1. Population

2. Affluence

3. Technology

4. Political & Economic Systems

5. Culture

Human Activities

1a. Hunting & Fishing

1b. Livestock

1c. Farming

1d. Forestry

1e. Mining

2. Industry

3. Services

4. Household Consumption

5. Transportation

Environmental Change

1. Energy / Material Redistribution

2. Pollution

3. Direct Biological Interference

Adverse Consequences

1. Adverse Human Consequences

2. Adverse Natural Consequences

Solutions

1. Prevention

2. Technological Change

3. Natural Feedbacks

4. Relocation & Land Use Change

5. Mitigation

6. Compensation

**The Disappearing
Aral Sea**

The Disappearing Aral Sea



И ЗАСУХУ
ПОБЕДИМ!



"Feed" vs. Evapotranspiration

Syr Darya

Amu Darya

UZBEKISTAN

KYRGYZISTAN

TAJIKISTAN

Kara Kum

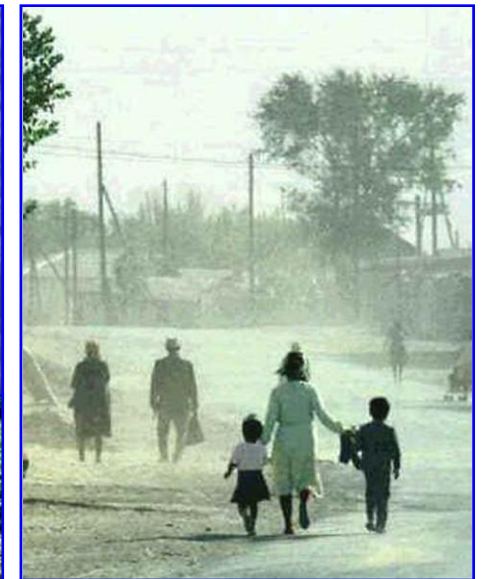
The Aral Sea basin lies in the Kara Kum desert in central Asia. It is now five independent countries, but they were all once "Soviet Socialist Republics" and part of the USSR. After World War II, the Soviet government decided they needed to move as many strategic industries away from the European front as they could. Many manufacturing concerns were moved to the Ural Mountains region. In central Asia, it was decided to use this for cotton (material needed to cloth people – and the army). The problem: this is a desert. Water evaporates VERY fast. Most of the blue lines you see on the map at left are manmade irrigation canals.... Feeding thousands of acres of cotton. Too much water has been diverted away from the Aral Sea by the "Virgin Lands Scheme" (overseen at right by then leader Josef Stalin). The water used by the plants for growth and transpiration and the high evaporation rates on so much exposed surface water....



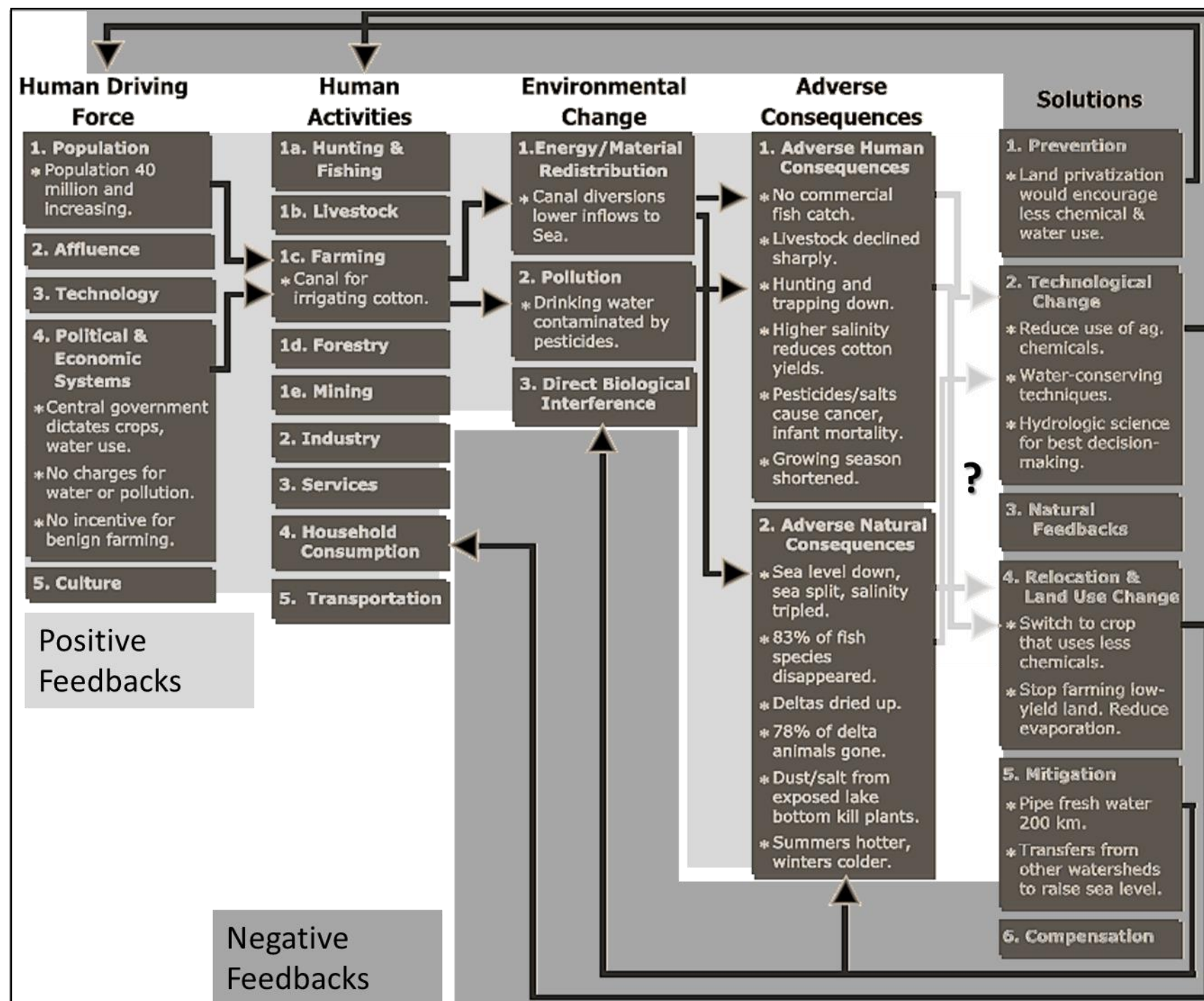
July – September, 1989



August 16, 2009



...and the impact on the Aral Sea basin has been huge. In the center satellite images, you can see what the Aral sea level was in 1960 (small inset image), in 1989 and in 2009. The southern part of the basin is nearly dry – and probably will be in your lifetime. The fishing industry was once important – but all the fish are gone, and so are the jobs in the fish processing house too. The lower left photo is what you'll find in many places today... abandoned fishing trawlers in the desert, miles away from any water. Adverse consequences: (besides no fish) include badly salted soils due to wind picking up salts from the exposed seabed, and cotton production in decline... plus, those wind-driven salts are very bad for your health. Cancers, respiratory diseases and infant mortality rates are increasing... and life expectancy in the region is decreasing. These are relatively poor countries, who cannot afford expensive solutions.



FEEDBACK LOOPS...

A complete ESA flowchart for the Aral Sea including the positive and negative feedback loops.

Positive Feedback: A cause-and-effect chain that begins with a change to a stock and ends up amplifying the original change and pushing the system further from equilibrium.

Positive feedback loops are not good when we are looking at environmental issues. "Positive" in this case mean that a problem has been created, and everything that comes after has adverse consequences for humans and/or the environment.

For example, the decision to raise cotton in a desert area (Human Driving Force → Human Activity) requires a LOT of water, and as more land was put into cotton production, more and more water was required to irrigate that land. Eventually, so much water was diverted away from the Aral Sea (Environmental Change – Energy & Material Redistribution) that the Aral Sea literally began to evaporate away.

Negative Feedback: A cause-and-effect chain that begins with a change to a stock and ends up reversing the original change and bringing the system back toward equilibrium.

- In this case, negative feedback means that one is trying to reverse the changes and restore the environment... "negative" in this case is a good thing. Solutions are difficult to implement, especially since the two countries in which the Aral Sea lies were once socialist republics of the USSR. Today, they are independent countries, poor enough that funding solutions to the problem is unlikely, and Russia (where the problem started, in Moscow) is unlikely to help or approve of any prior ideas, such as rechanneling water from other rivers (which now lie inside Russia).