



INTERNATIONAL CONFERENCE.

ARAL:PAST, PRESENT & FUTURE/TWO CENTURIES OF THE ARAL  
SEA INVESTIGATIONS

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SCIENTIFIC AND APPLIED PROBLEMS OF THE  
ORGANIZATION OF THE LANDSCAPE-  
ECOLOGICAL MONITORING  
IN SOUTHERN PRIARALYIE

Water Problems Institute RAS  
Moscow--Saint-Petersburg  
2009

# LANDSCAPE-ECOLOGICAL MONITORING

## The purpose:

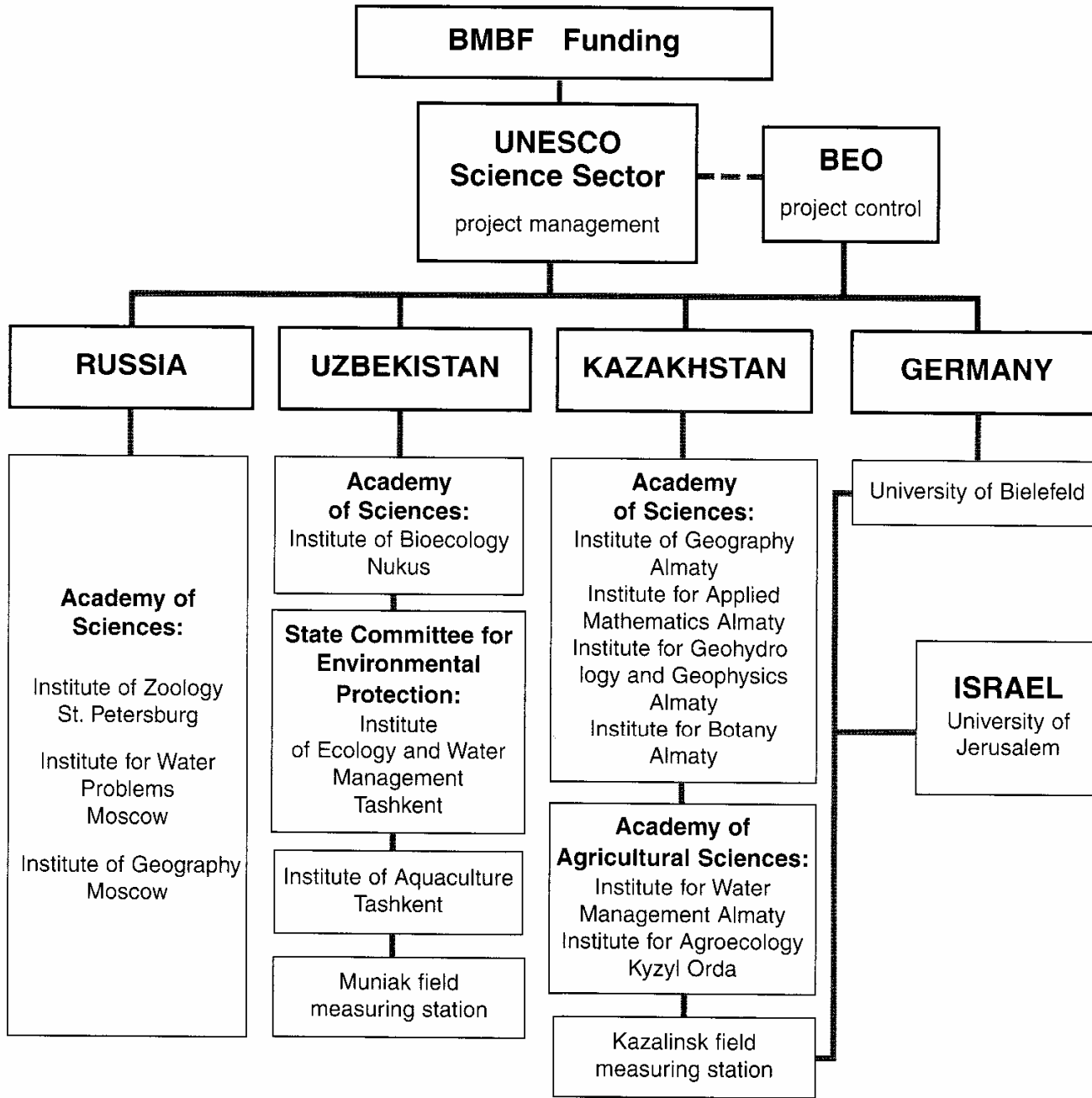
Provide scientific-information base for the organization of rational wildlife management and nature preservation, **obtaining of new knowledge and examination of scientific hypotheses**

## Tasks:

- Studying tendencies of development of regional ecological factors;
- Revealing the current condition at a landscape level;
- An estimation of a current condition and revealing of the dangerous phenomena and processes;
- **The forecast** of natural development and at offered actions;
- **Recommendations** for the organization of sustainable wildlife management and preservation of unique natural complexes and a biodiversity;
- **Perfection of methodical and organizational bases of monitoring;**
- **Checking of existing scientific hypotheses and theories about laws of landscapes dynamics and development new.**

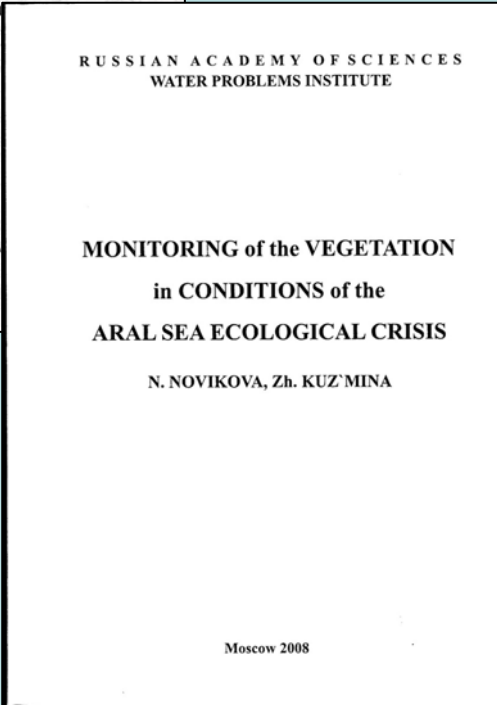
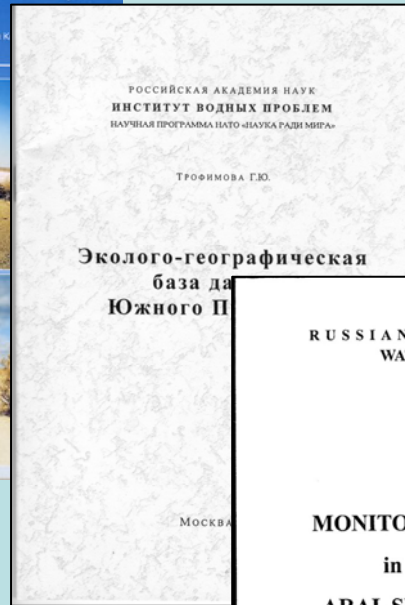
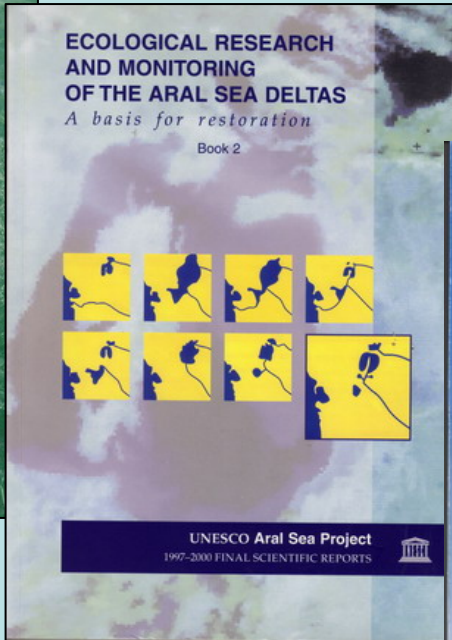
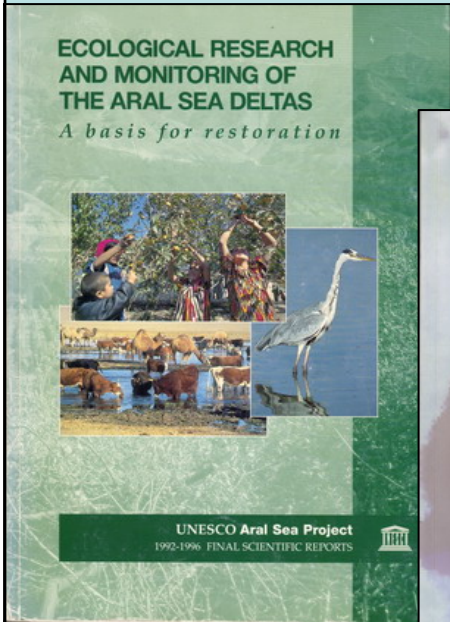
# HISTORY

- **1980-1985** – the state programs of studying and the forecast of change of Aral sea and adjoining territories within the framework of the Academy of sciences of the USSR and Academies of sciences of Kazakhstan and Uzbekistan;
- **1992-2000** – within the framework of 22 projects of UNESCO / Germany (BMBF) - «Ecological research and monitoring of the Aral Sea deltas»;
- **2000-2003** – NATO project «Sustainable development of Ecology, Land and water Use through Implementation of a GIS and Remote Sensing Centre in Karakalpakstan, Uzbekistan»;
- **2005-...** Project GTZ ... «Stabilization and use of the drained bottom of Aral sea in the Central Asia »
- **2005-2009.....**



**Structure of the Aral sea UNESCO/BMBF of Germany project**





**Publications within the UNESCO/BMBF of  
Germany Aral Sea Project and many non  
printed reports**

## **THE SAVED UP SCIENTIFIC EXPERIENCE: THEORETICAL POSITIONS**

- The ecological-genetic concept of landscape-ecological monitoring is developed and approved
- In Priaralyie develops process of climatic desertification initiated by man;
- It is process of natural evolution of landscapes, directed to formation of desert zonal complexes, there are allocated some stages;
- Stages depend on types of landscapes;
- Speed of process of transformation of natural complexes depends on a stage on which was territories to the initial moment;
- Speed of desertification is influenced with regional climatic and hydrological processes;

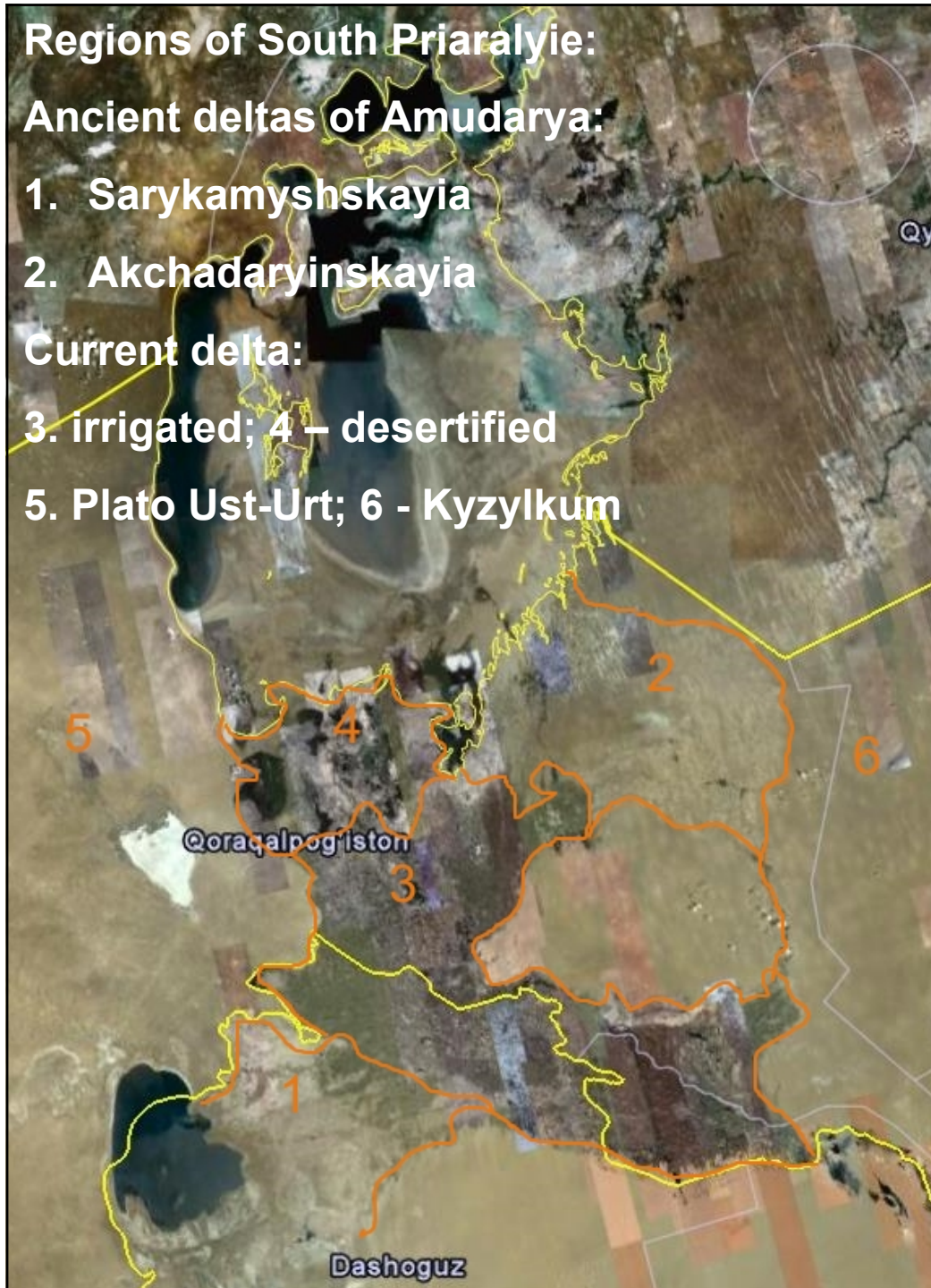
## Regions of South Priaralyie:

### Ancient deltas of Amudarya:

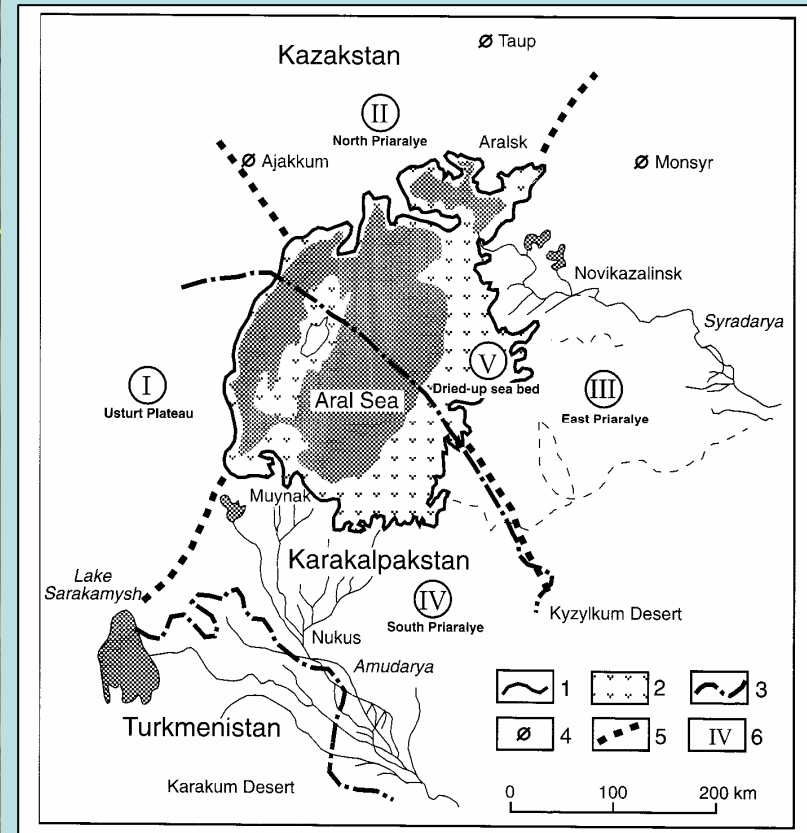
1. Sarykamyshskaya
2. Akchadaryinskaya

### Current delta:

3. irrigated; 4 – desertified
5. Plato Ust-Urt; 6 - Kyzylkum



## Regions of Priaralyie, according to prevailing types of landscapes and their changes due to aridization

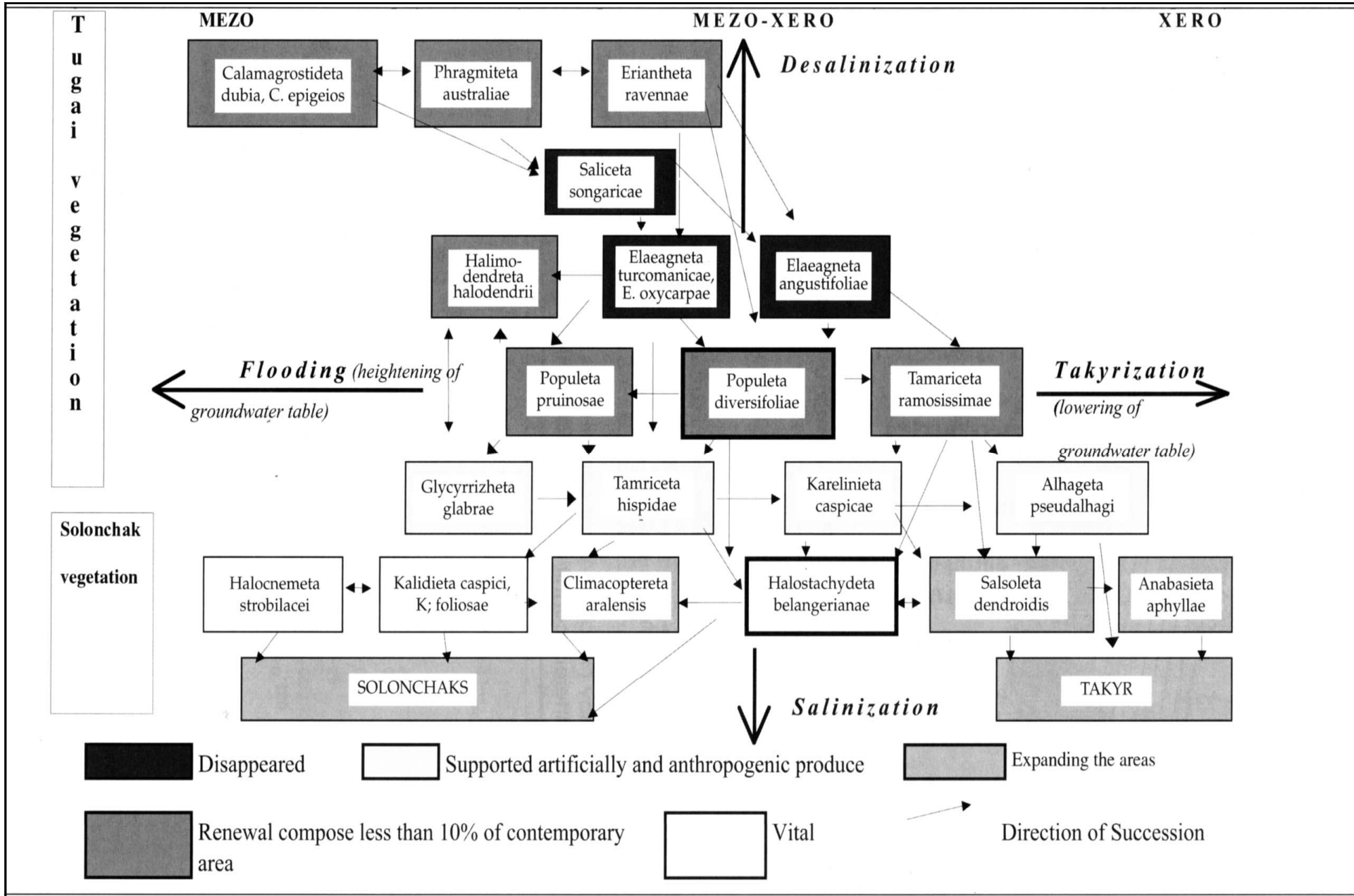




Components of landscape	S t a g e s		
	Hydromorphic	Subhydromorphic	Automorphic
source of water	flooding, groundwaters, precipitation	ground waters, precipitation	precipitation
groundwaters	0–3.5 m, fresh-brackish	>3.5–5 m, salinized	>5 (10–20) m, high salt content
soil forming processes	swamp, meadow, solonchak	takyrisation	zonal desert
phytomass (T/ha)	75.46–41.27	49.1–8.25	27.05–5.29
production (T/ha/year)	10.7–36.87	25.1–3.05	2.18–1.89
types of succession on the levees	dominants of plant community series on the levees		
xerophytization	<i>Populus ariana</i> , <i>Elaeagnus turcomanica</i> , <i>Tamarix</i> sp., <i>Glycyrrhiza glabra</i> , <i>Alhagi pseudalhagi</i>	Desert tugai communities + ephemerals, <i>Capparis decidua</i> , <i>Salsola dendroides</i>	
halophytization	<i>Tamarix hispida</i> , <i>Aeluropus littoralis</i> , <i>Karelinia caspia</i> , <i>Halostachys caspica</i> , <i>Climacoptera aralensis</i> , <i>C. lanata</i>		
psammofitization by destruction of upper kleyer layer, sands appearing	—	<i>Haloxylon aphyllum</i> , <i>Salsola orientalis</i>	<i>Ceratoides papposa</i> , <i>Calligonum</i> sp., <i>Salsola richteri</i> , <i>Haloxylon persicum</i>
siltation (aeolian input to depression in the sandy area)	—	—	Ephemerals and low sub-shrub communities ( <i>Artemisia</i> sp.)
types of the successions on the interstream lowlands	dominants of plant community series on the inter-river lowlands		
xerophytization	<i>Typha angustifolia</i> , <i>Phragmites australis</i> <i>Calamagrostis dubia</i> , <i>Tamarix</i> sp.	<i>Salsola dendroides</i> , <i>Anabasis aphylla</i> , <i>Haloxylon aphyllum</i>	Takyr with algae and moss
halophytization	<i>Limonium gmelini</i> , <i>Salsola</i> sp., <i>Tamarix hispida</i> , <i>Halostachys caspica</i>	—	—
psammofitization	hillock sands formed by sand accumulation with high content of salt dust, covering by crust, <i>Lycium ruthenicum</i> , <i>Nitraria</i> sp.	—	<i>Anabasis salsa</i> + ephemerals, <i>Artemisia</i> sp., <i>Calligonum</i> sp., <i>Salsola richteri</i> , <i>Haloxylon persicum</i>
siltation (aeolian input to depression in the sandy area)	—	—	Ephemerals and low sub-shrub communities ( <i>Artemisia</i> sp.)

## Stages of the landscapes development within the evolution process of the deltaic landscapes





**Model of the dynamic links of deltaic ecosystems as uniform system**

# Stages of the processes and its indicators in the Amudarya delta



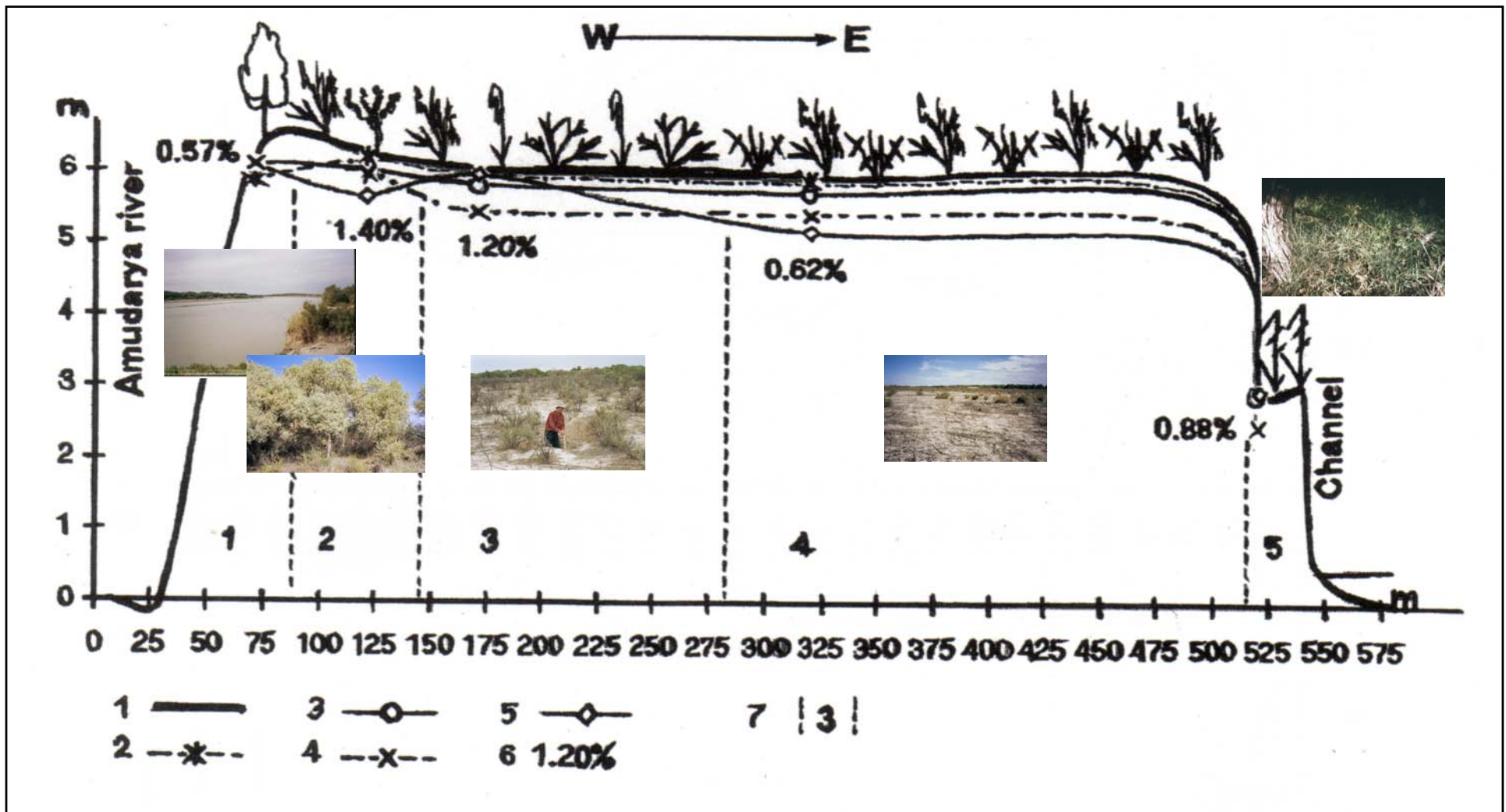
- **1985** – Beginning of solonchaks degradation, ground waters on depth more than 3 m. - the indicator - ***Salsola dendroides***



- **1993** - Beginning of progradation - processes dissemination of deserted plants - ***Haloxylon aphyllum*** and ***Krascheninnikovia ceratoides***



- **2000** - Dissemination of desert "repair" annual species ***Ceratocarpus arenaria***



Designations: 1 – relief (relative heights to the sea-level); 2 – 5 – depth of the layer of maximum soluble salts content (m): 2-1979; 3 -1985; 4 -1993; 5 -1999; 6 – maximum values of soluble salts content (%) in 1999; 7- numbers of key sites and names of plant communities along profile: 1. *Populus ariana-Tamarix ramosissima-Mixteherbosa* 2. *Halostachys belangeriana-Tamarix ramosissima-Ephemerosa* 3. *T. ramosissima-Ephemerosa* 4. *T.ramosissima- Salsola dendroides* 5. *Calamagrostis epigeios-Mixteherbosa*



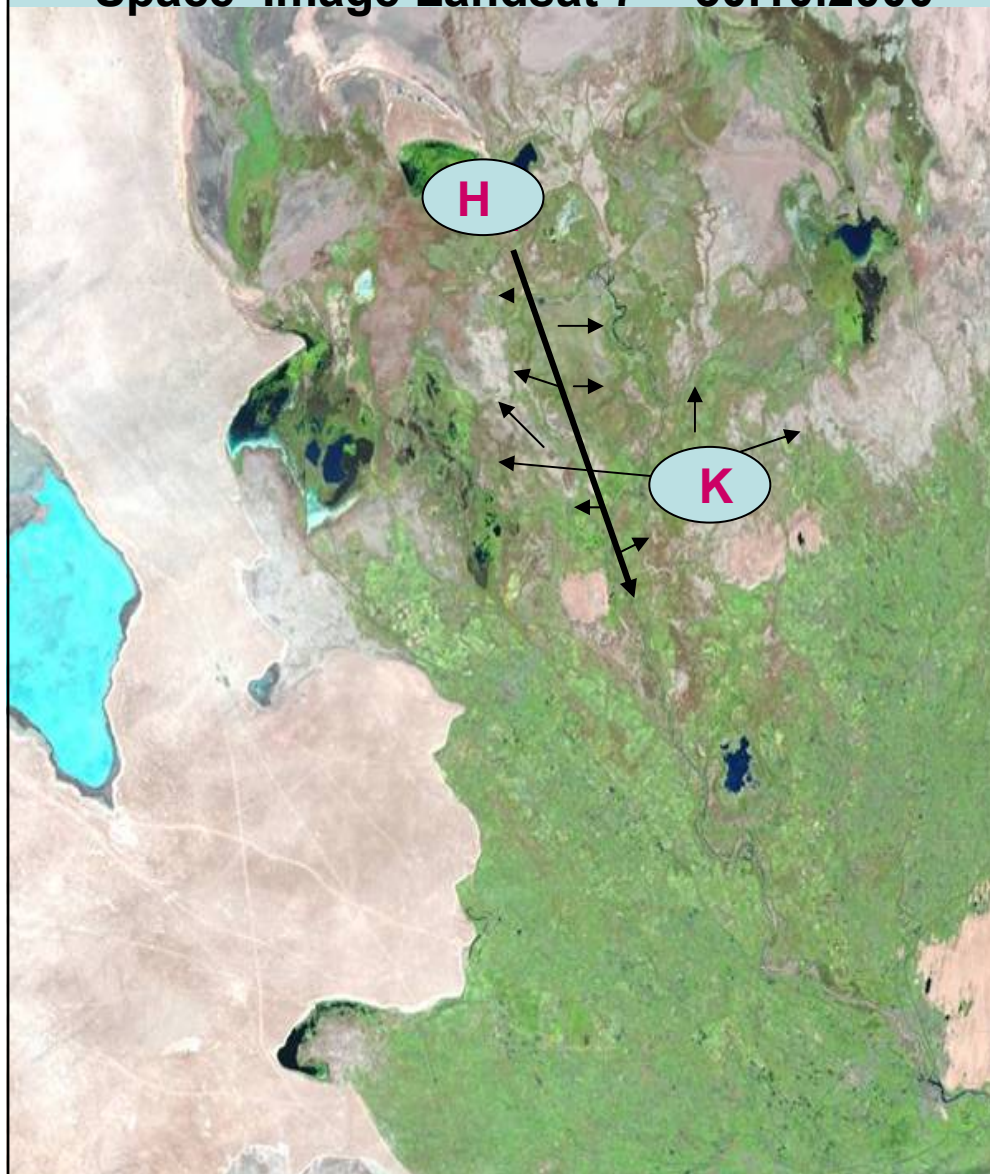
# DIFFERENCE BETWEEN FORECASTING AND REAL PROCESSES

- Local mechanisms and causes - applicative processes
- Ecotonal stages



# Delta of Amudarya

Space Image Landsat 7 - 30.10.2000



Local applicative factor –  
disturbance along roads

Results:

Dissemination of the desert plants  
Ecotonal communities

Speeding of the process of  
desertification



*Haloxylon aphyllum* (Minkw.) Iljin



*Krascheninnikovia ceratoides* (L.) Gueldenst.





**Local applicative factor –  
flooding:**

**Result – short living process**

**Solonchak after long natural  
flooding**





## **DRIED SEA BOTTOM - ARALCUM:**

**Soils:** saline, formed deserted sandy,  
formed brown

**Vegetation:** rarefied thicket serial  
communities, monocoenoses

**Dominates:**

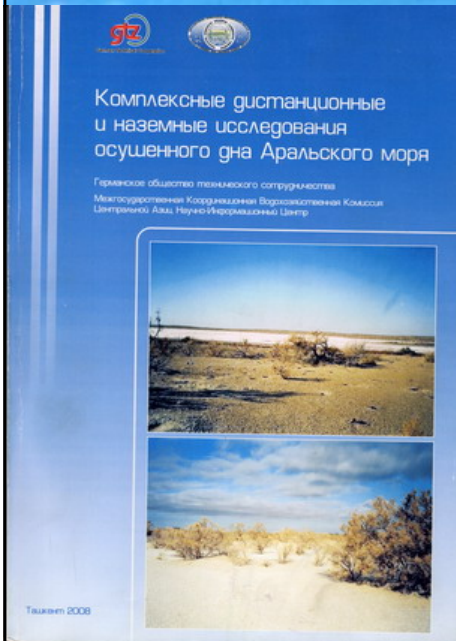
***Tamarix elongata*, *T. hispida*, *T.*  
*ramosissima*, *Halostachys caspica***



***Nitraria  
schoberi* L.  
blooming**



# DRIED SEA BOTTOM



**The main scientific problems :**

**Absence of the reliable data on stages and speeds of processes that it is important for the forecasting**

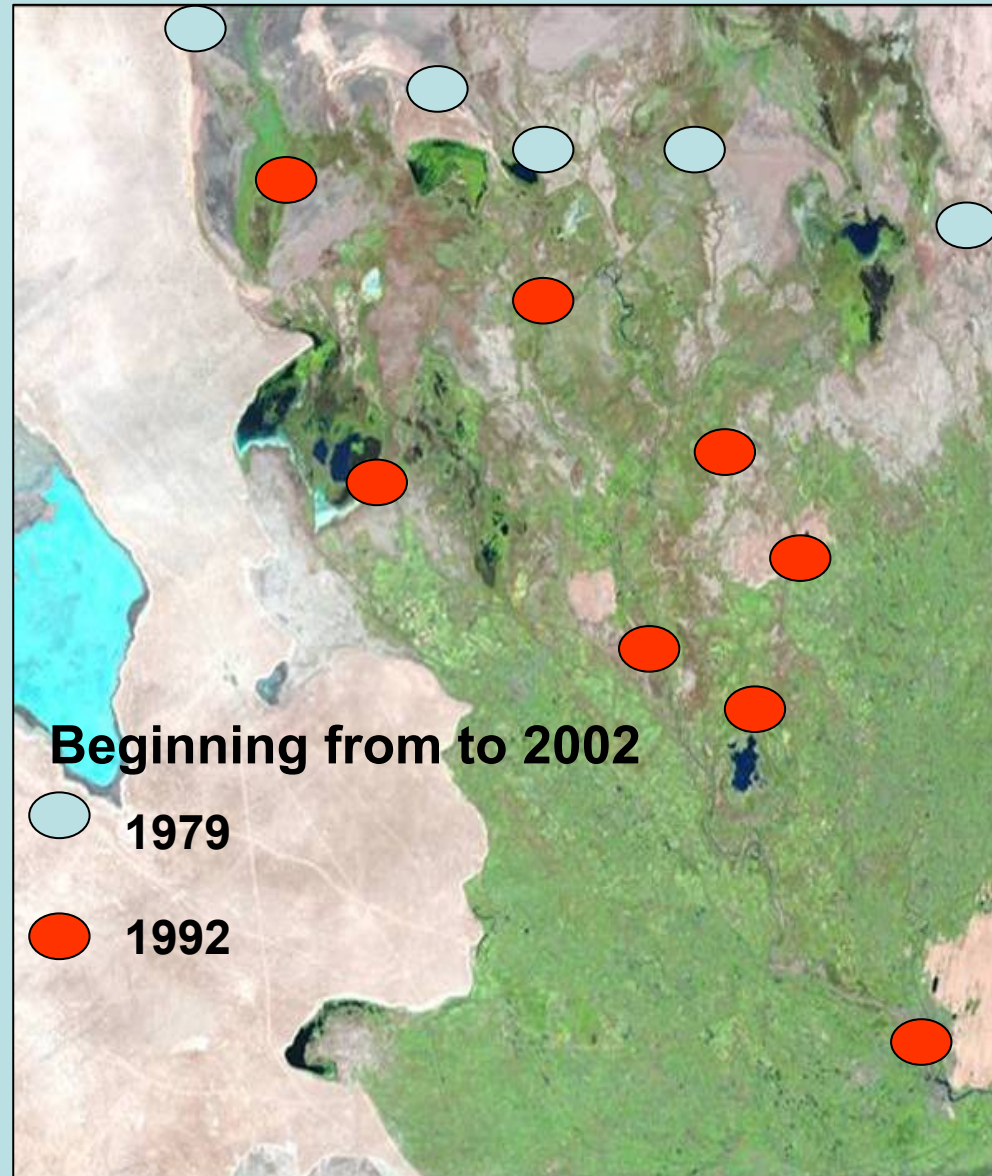
**Consequences of applicative local direct and nondirect anthropogenic impacts for future development of landscape processes**

## **PRACTICAL AND APPLIED PROBLEMS:**

- 1. Absence of continuation of the landscape-ecological terrestrial monitoring begun in 1970-e years**
- 2. Organization**
- 3. Objective: Destruction of ecosystem of Badaj-Tugaj reserve because of absence of water**



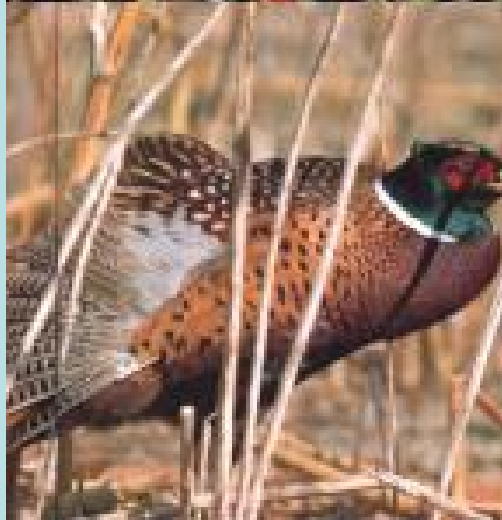
# POINTS OF MONITORING - a history



# The reserve Badaj-Tugaj



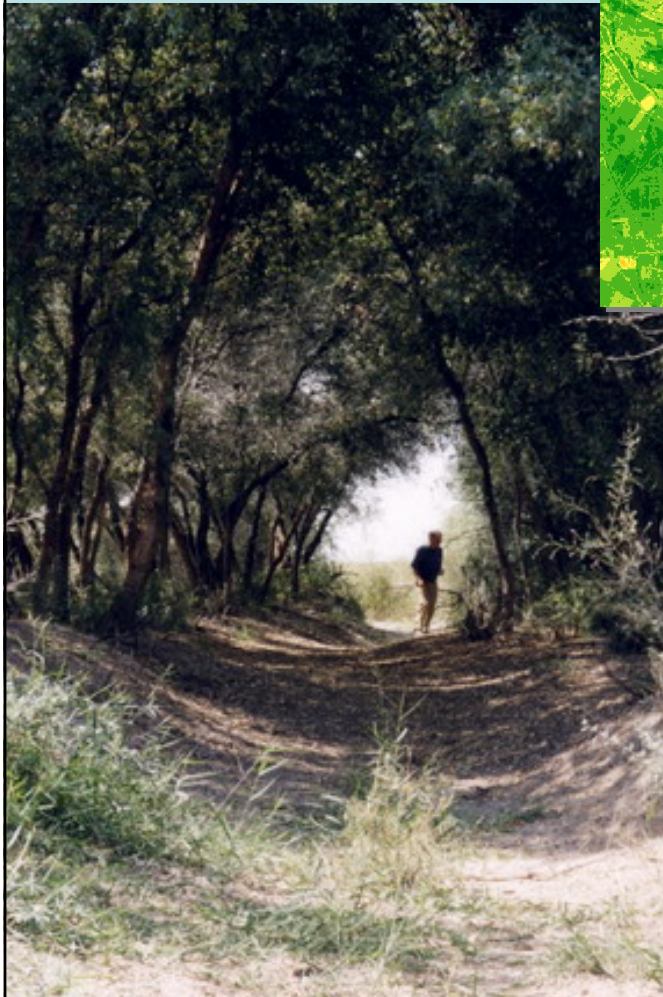
**Заповедник Бадай-Тугай.  
CD-ROM для экологического  
просвещения.**



**Created for  
protection tugai  
and deserted  
ecosystems with  
all characteristic  
species of animals  
and plants**



# Current state of the Badaj –Tugaj





**БЛАГОДАРЮ ЗА ВНИМАНИЕ**

**THANK YOU**

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