Project funded by the EUROPEAN UNION

SciNet NatHaz Prevention

Common borders. Common solutions.

SciNet NatHazPrev Project

WORKSHOP, MARCH 13-14, 2014, ISTANBUL, TURKEY

Facts regarding the flood problem in the Evros/Maritsa/Meric transboundary river basin*. Prerequisites for its effective management

(*) Bulgaria-Turkey- Greece

Dr. S. Skias
Democritus University of Thrace (P1)
Department of Civil Engineering
Geotechnical Division
Xanthi-GREECE

Floods 2006, “Lavara” riparian Village, Evros Prefecture, GR, loc. In transb. Evros/M/M basin.

Several tens of houses have been evacuated

Transb. R. Evros Basin: Floods 2005 and 2006, the same picture!!

First time, Jan. 2007, Decision, EU **Solidarity Fund**: **9.3 mill**. **€** for flood compensation granted to **Greece**

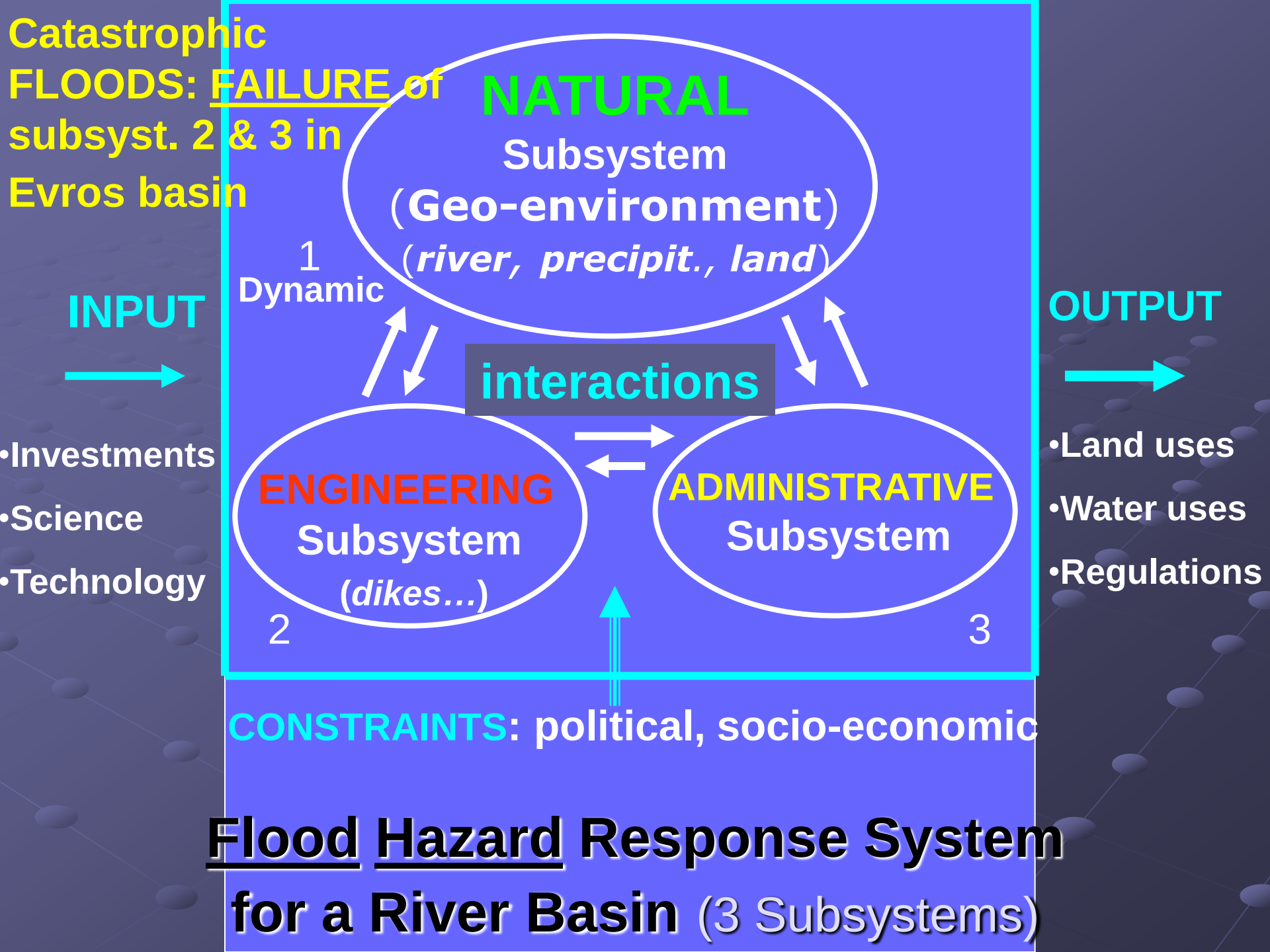
- **Estimated economic losses, only in public infrastructure, from 2006 flood events in the Greek part of Evros River Basin: >30 mill. €**
- **Edirne city, TURKEY: >25 mill. € damages**

Edirne, Turkey March 2005

Floods 2005

(From D.S.I. – Edirne, Turkey, 14 September, 2005)

Catastrophic FLOODS: FAILURE of subsyst. 2 & 3 in Evros basin



Flood Hazard Response System for a River Basin (3 Subsystems)

General remarks on global reality regarding Transb. Water. R. Manag. issues…

- Increasingly complicated world with great differences and inequalities among neighboring / riparian countries (e.g. S-E Europe / BALKANS)…..
- Not easy solutions to big & long-lasting problems due to political, socio-economic, cultural & environmental constrains-barriers-complexities
- Need for effective COOPERATION based on efficient RULES {*Intern. & Domestic LAW* } and on modern Diplomatic means {e.g. *Hydrodiplomacy* }
- Need for Interdisciplinary & Holistic-Integrated approaches

Prerequisites for SOUND Cooperation:

- ***both Willingness (?…) + Capability (?…) by the engaged riparian countries***
- ***Good services from Third Parties (reliable + capable) through effective incentives (positive & negative)***

Fresh Water Rec. Management *on a transition period towards an INTEGRATED status (IWRM) through a WHOLE basin (watershed / catchment) approach…*

A Slow and Difficult ongoing process:

- From **Hydro-hegemony** and "**Zero Sums**" to **Hydro-solidarity and "Plus Sums (i.e. all WIN)"** through **Hydro-diplomacy**,
- From unlimited **Growth** to **Sustainability models**
- From **Fragmentation** to **Integration / Holistic** approach on space and time
- Requiring **Paradigm shifts** based on **New concepts**: **Benefit Sharing**, **Prevention**, **Adaptation (climate change…,)**
- **Means:** ***"Best Practices"*** underpining **All** the above ***new concepts* + adequate *FUNDING for implementation!!!*…**

Transboundary Water Resources: *some basic quantitative data*

- **60%** of global river flow in transboundary basins (~**275** international rivers).
- **EUROPE**: **71** transb. basins, **54%** of total area
- In **Mediteranean** & **S-E Europe >80%!**
- **All major groundwater** aquifers are **transboundary**
- **40%** of worlds population live in **transboundary** basins
- **145 nations** have territory within **transboundary** river basins
- **>3.600 bilateral** and **Intern**. Agreements...

Shared Rivers in SE Europe (Balkans) sub-Danubian countries: basic facts

A COMPLICATED political + natural environment !!

- **Prior to 1992:** six (6) Transbaundary Rivers (T.R.) (Aoos/Vjosa, Drim, Axios/Vardar, Strymon/Struma, Nestos/Mesta, and Evros/Maritza/Meric)
- **At present:** (14) T.R. (Sava, Kupa/Colpa, Cetina, Una, Drina, Skutari/Shcotar, Neretva and Trebisnjica).

Seventeen (17) Transb. Riv. Basins* (*4* of them are Intern. Sub-basins of R. Evros/Maritza/Meric System)*

- ~90 % of the total area is within intern.basins
- Average regional water dependency ratio on external resources is 66 %

5 Transboundary River Basins shared by Greece* (4 down stream country +1 up stream country)*

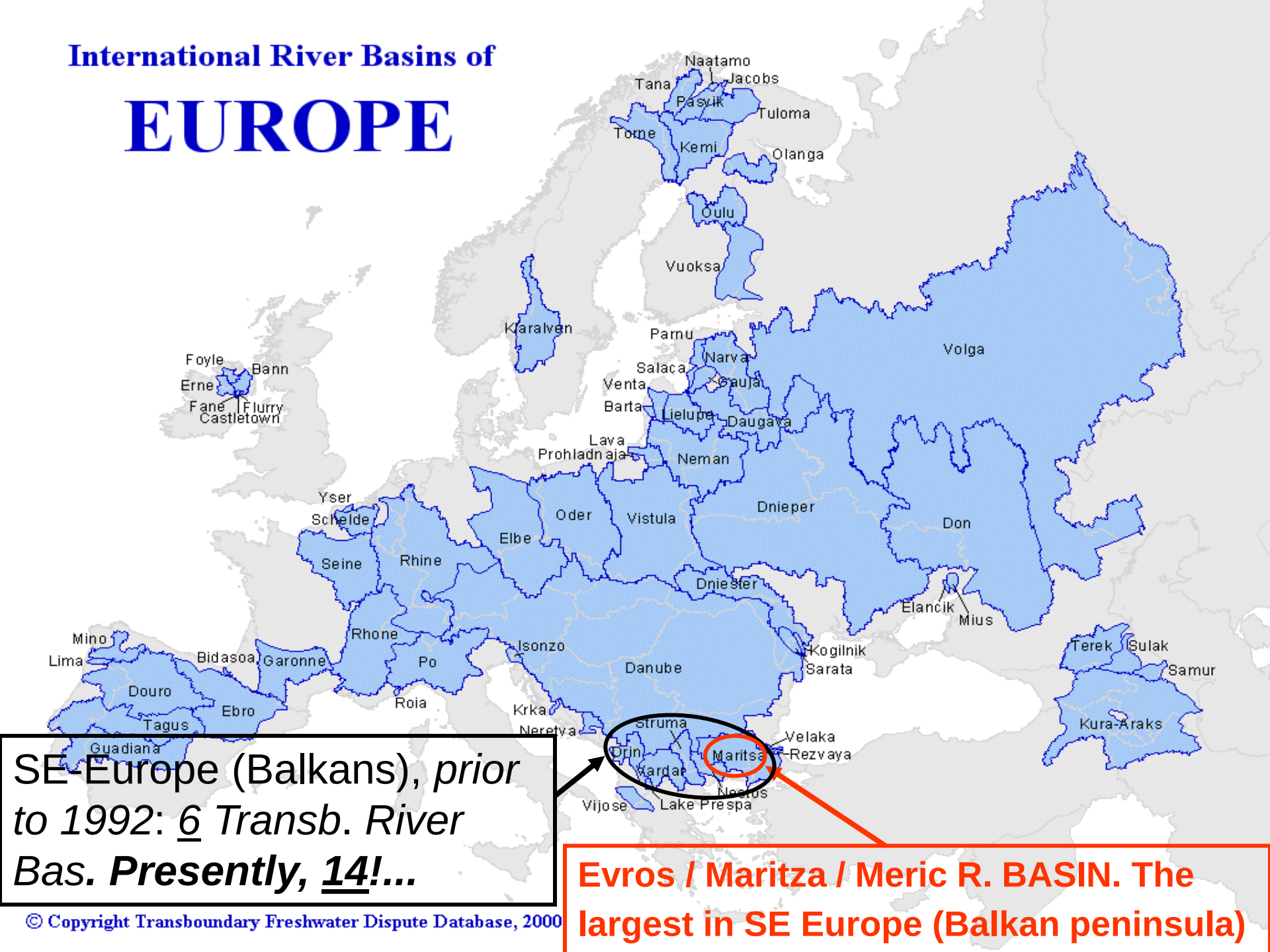
River name	Source country	Outfall country	Sharing countries	Total length (km)	Length on Greek territory (Km)	Total size of basin (km^2)	Size of basin on Greek territory (km^2)
Maritza/ Evros*/ Meric	Bulgaria	Greece/Sea of Thrace	Bulgaria Greece Turkey	550	204	53.000	3180
Nestos/ Mesta	Bulgaria	Greece/Sea of Thrace	Bulgaria Greece	234	130	5.800	2.320
Strymon /Struma	Bulgaria	Greece/Northern Aegean Sea	Bulgaria Greece	400	118	18.078	7.281
Axios/ Vardar	FYROM	Greece/ Thermaikos Gulf	FYROM Greece	380	76	24.338	2981
Aoos/ Vjosa	Greece	Albania/ Adriatic Sea	Greece Albania	260	70	6.519	2.154

**The tributary Ardas: length 30 Km on Greek territory (of total 270), river basin 345 km^2 (of total 5.545)*

Dependence of Greece on Transb. Waters (Rivers + Lakes)

- **~ 25% of the country's renewable water resources are "imported".**
- **Catchments** of transb. rivers entering Greece cover an **area ~ 98000 km2**, of which only **14% Greek, while 40% (18 km3/a)** contributing to the country's freshwater runoff reach
- Greek **transb. rivers** are the **most polluted**, among all greek rivers, with the **Evros/Maritsa/Meric at the top**, due, **mainly** to **"imported" pollution (of all kinds…)**

International River Basins of EUROPE

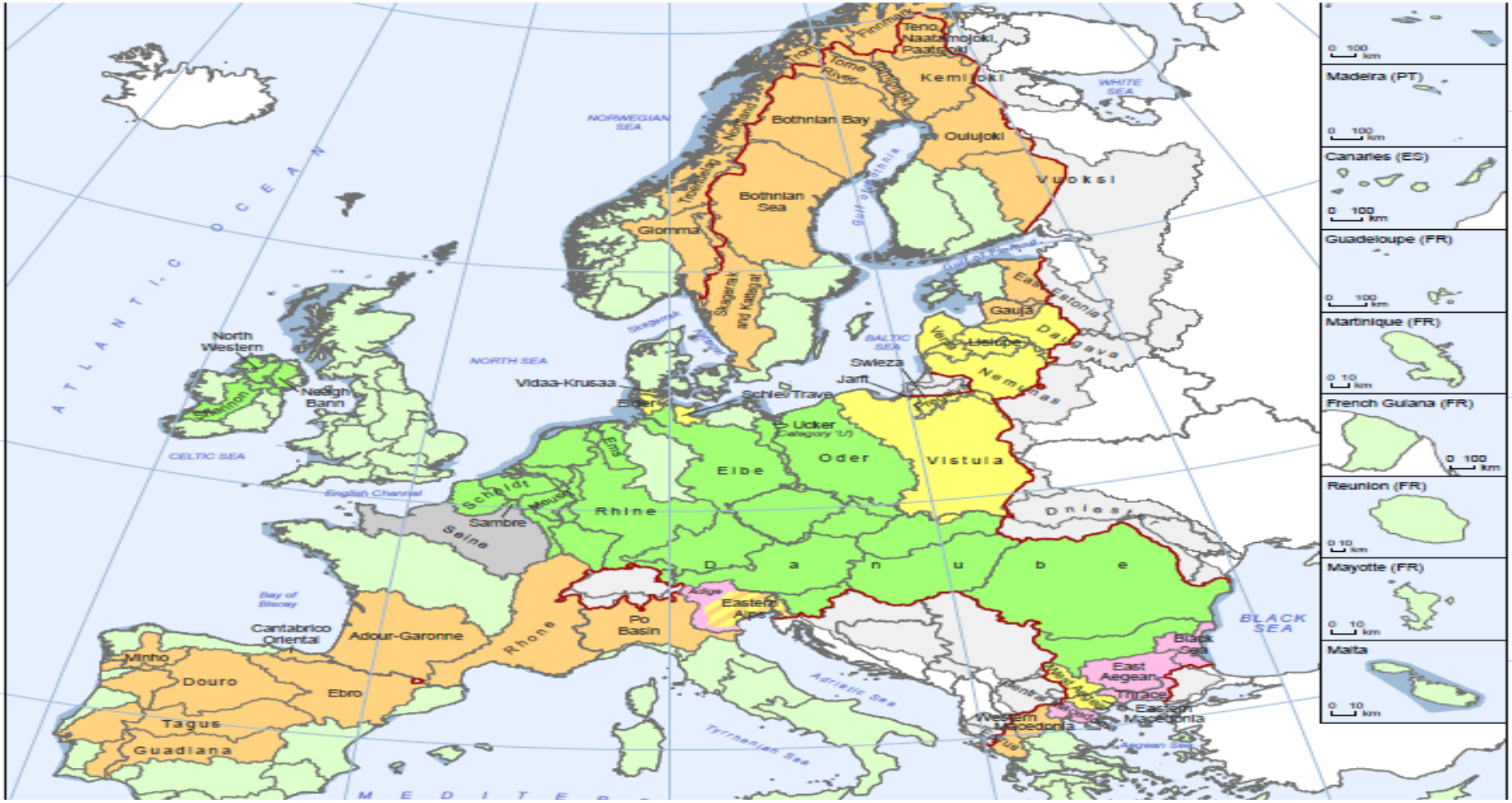


SE-Europe (Balkans), *prior to 1992*: *6 Transb. River Bas*. ***Presently, 14!...***

Evros / Maritza / Meric R. BASIN. The largest in SE Europe (Balkan peninsula)

Map of EU River Basin Districts indicating transboundary co-operation

Version 29 October 2012



EU River Basin Districts indicating transboundary co-operation

- Category 1: Co-operation agreement, co-operation body and international RBMP in place
- Category 2: Co-operation agreement and co-operation body in place, but no international RBMP in place
- Category 3: Co-operation agreement in place but no co-operation body or international RBMP in place
- Category 2/3: Not clear whether both co-operation agreement and co-operation body in place
- Category 4: No co-operation formalised
- Uncategorised

- National River Basin Districts (within the EU)
- International River Basin Districts (outside the EU)
- Coastal waters
- Country borders
- EU27 extent

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Evros / Maritsa / Meric Transb. R. Basin (BL-TR-GR)

Map produced by WRc plc on behalf of the European Commission©, DG Environment, 2012

EU Transb. R. Basins: 4 categories

1st Co-operation: Int. Agreement, Int. Body and Int. Master Plan
e.g. Rivers: Danube, Rhine, Elbe, Oder

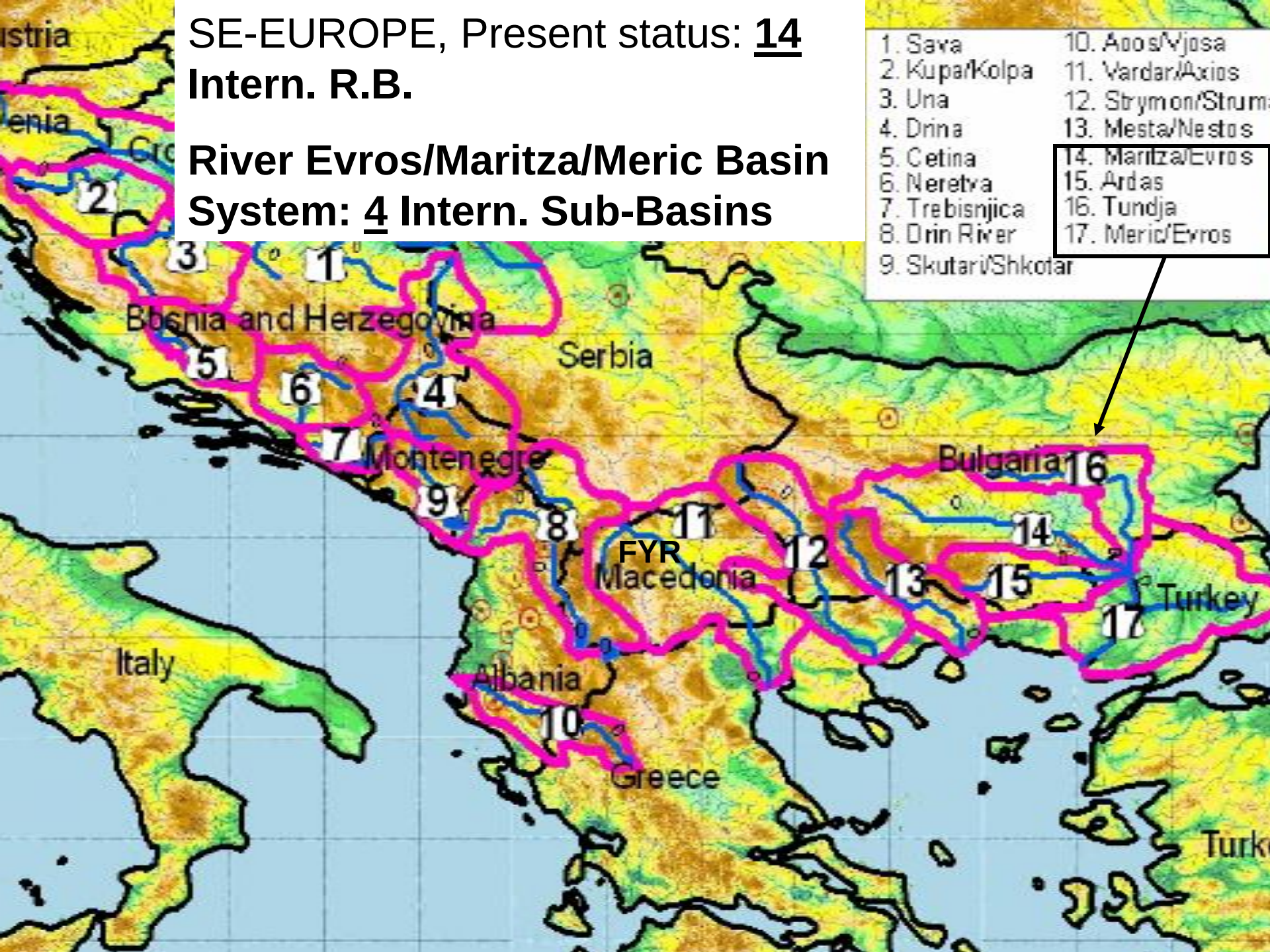
2nd Co-operation: Int. Agreement, Int. Body, NO Manag. Plan

3rd Co-operation: Int. Agreement, NO Int. Body and Int. M. Plan

4th Co-operation: NO Int. Agreement, Int. Body and Int. M. Plan
e.g. R. Evros/Maritsa/Meric Transb. R. basin

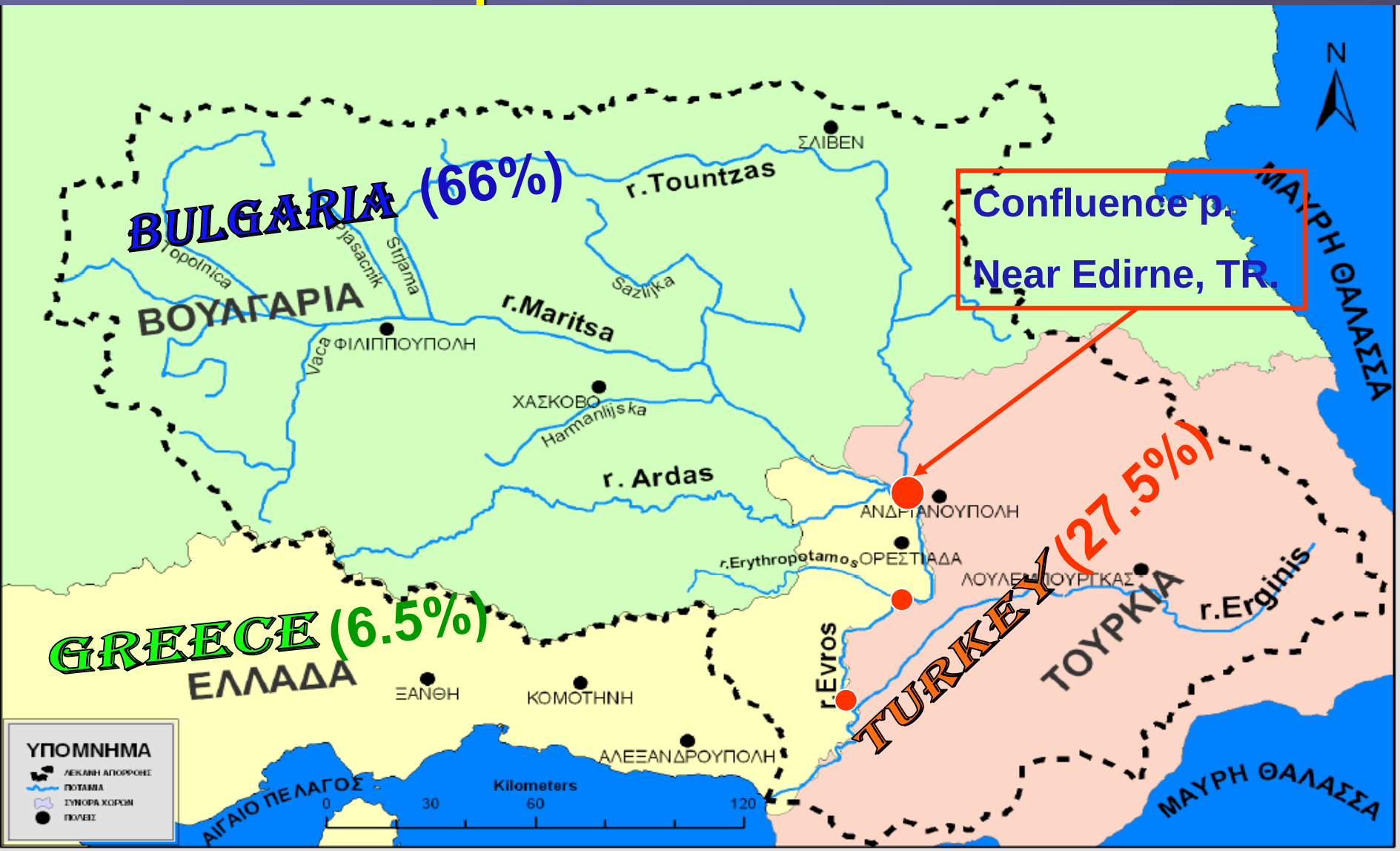
***NOTICE*: very few Transb. R. Basins in EU territory remain, at present, in the 4th category, as it is the case of Evros/Maritsa/Meric!!**

SE-EUROPE: **below Danube river, EU-members: only (4)** ***(Greece, Slovenia Bulgaria and Croatia)***

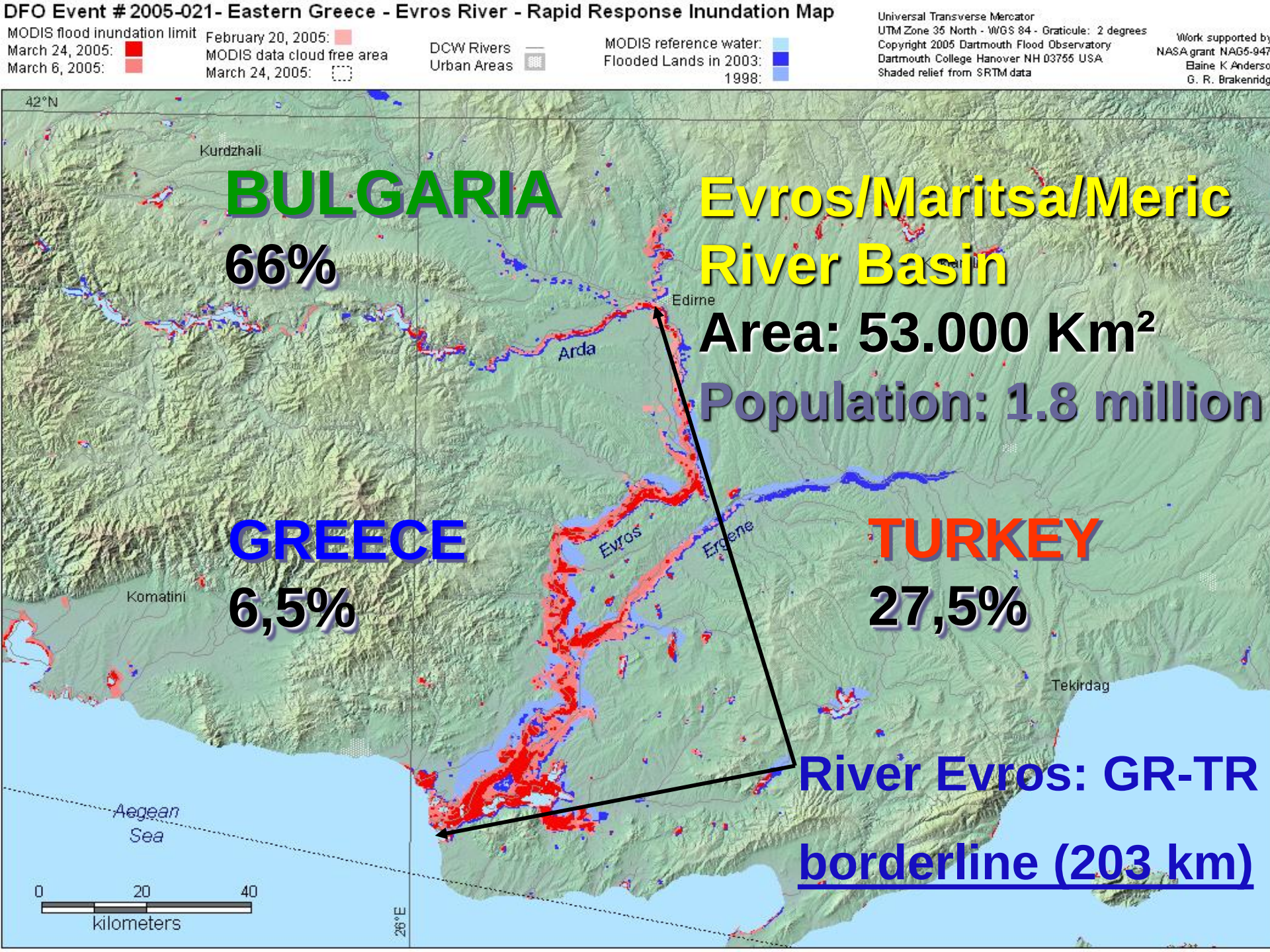

SE-EUROPE, Present status: 14 Intern. R.B.
River Evros/Maritza/Meric Basin System: 4 Intern. Sub-Basins
1. Sava
2. Kupa/Kolpa
3. Una
4. Drina
5. Cetina
6. Neretva
7. Trebisnjica
8. Drin River
9. Skutari/Shkotar
10. Aoos/Vjosa
11. Vardar/Axios
12. Strymon/Struma
13. Mesta/Nestos
14. Maritza/Evros
15. Ardas
16. Tundja
17. Meric/Evros
Bosnia and Herzegovina
Serbia
Montenegro
Bulgaria
FYR Macedonia
Turkey
Italy
Albania
Greece

3 Transboundary Aquifers (inside red line) alluvium (blue color) & karstic (green) within the River Evros/Maritsa/Meric Basin

The Evros/Maritsa/Meric River Basin: 53.000 sq. km, shared by 3 riparian countries: BL up-stream, TR & GR down-stream part.



Geoph. map of the r. Evros trans. basin


DFO Event # 2005-021- Eastern Greece - Evros River - Rapid Response Inundation Map
MODIS flood inundation limit
March 24, 2005:
March 6, 2005:
February 20, 2005:
MODIS data cloud free area
March 24, 2005:
DCW Rivers
Urban Areas
MODIS reference water:
Flooded Lands in 2003:
1998:
Universal Transverse Mercator
UTM Zone 35 North - WGS 84 - Graticule: 2 degrees
Copyright 2005 Dartmouth Flood Observatory
Dartmouth College Hanover NH 03755 USA
Shaded relief from SRTM data
Work supported by
NASA grant NAG5-947
Elaine K Anderso
G. R. Brakenridg
42°N
Kurdzhali
BULGARIA
66%
Evros/Maritsa/Meric
River Basin
Area: 53.000 Km²
Population: 1.8 million
Edirne
Arda
Evros
Ergene
GREECE
6,5%
TURKEY
27,5%
Komatini
Tekirdag
River Evros: GR-TR
borderline (203 km)
Aegean
Sea
0
20
40
kilometers
26°E

System of River Evros/Maritza/Meric transboundary basin: 4 shared transb. sub-basins (Evros + 3 tributaries, *Tundza, Arda, Ergene)*

River Evros/Maritsa/meric system: Basic data

- **Basin**: area **~ 53,000 km2**
- **Delta** area **~188 km2** (Natura 2000 and Ramsar Convention), shared by **Greece (90%)** and Turkey
- **4 main tributaries area**: **Ergenes (Turkey)**, 20.5%*, **Tundzha (BUl.-TR)** 16%*, **Ardas** 11% and **Erythropotamos (Greece)** 3%*.

(*) of total basin area

~Spatial Allocation of the r. basin area:

- **Bulgaria**: (**up**-stream, new EU mem.), **66,0%**
- **Turkey**: (**down**-stream, non EU mem.), **27.5%**
- **Greece**: (**down**-stream, old EU mem.), **6.5%**

- River Headwaters in the Rila mountain-chain (Bulgaria), mouth in NE Aegean Sea

- **Main river course**: **~528** km, 310km belong to Bulgaria and 218km the **border** line between **Greece** and **Turkey**.

- Annual aver. discharge fluct.: 50 to 200m3/s

- Evros river **catchment** area is one of the most **intensively** cultivated areas in the **Balkans** and supports a **population of 3.6 million people**

R. Evros/Maritsa/Meric Transb. Basin:
Basic water related, environmental problems

***I. Qualitative* :**

- Water **Pollution** (surface and underground) from Point + diffuse s.: **Agricultural, Urban, Industrial-Mining.**
- **Pollution increases down-stream**, along the course of the river, towards its mouth-delta
- **Climatic** and **human-origin PRESSURES** on the aquatic ecosystems (**DELTA, Rivers, Lakes**)
- Spatial **Elimination**, **Deforestation**, and **Degradation** of Natural **Floodplains.**
- Negative role of present position and structure of **dikes and other flood** protection systems on **health** of all nat. **ecosystems**

II. Quantitative water-related problems:

- Repeated catastrophic **Flooding.**

Max. record. Flood, y. 1940. More recent y. 2012

Huge direct +indirect costs on annual basis!

- Repeated **Droughts** and water-scarcity due to seasonal fluctuations, climatic changes and aquifer **over-pumping, mainly** for **irrigation** (intensive farming)

Basic-main causes of Floods on a WHOLE basin scale : natural & anthropogenic

- **Natural**: Intensive and long duration rainfalls AND / OR fast snow melting rainfall in the up stream part of the basin
- **Anthropogenic**:

1. operational **mismanagement**, regarding **flood control**, of the **large reservoirs of the H/E dams** in the Bulgarian up stream part of the basin (priority to max. w. level for max. productivity (H/E & irrigation w.)
2. improper spatial distribution and technical characteristics of the **flood defence line-systems** of **dikes** and other protection systems in the whole basin
3. **intervention** in the **nat. flood plains** & nat. ecosystems (great **reduction**, land use change) and in the **channel/bed** characteristics of the **river system**

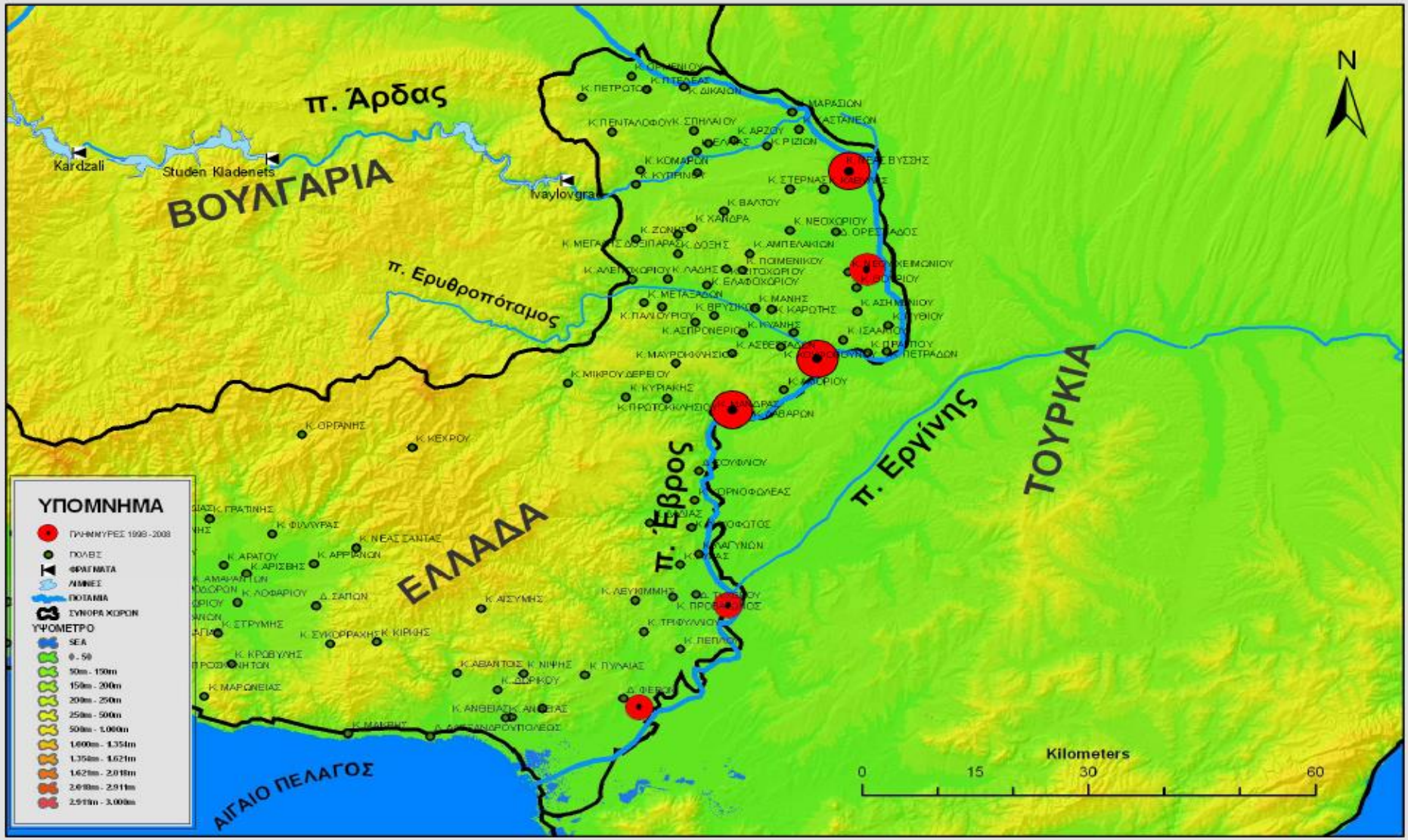
Bulgarian Dams: great increase of the frequency of flood events

Facts-data:

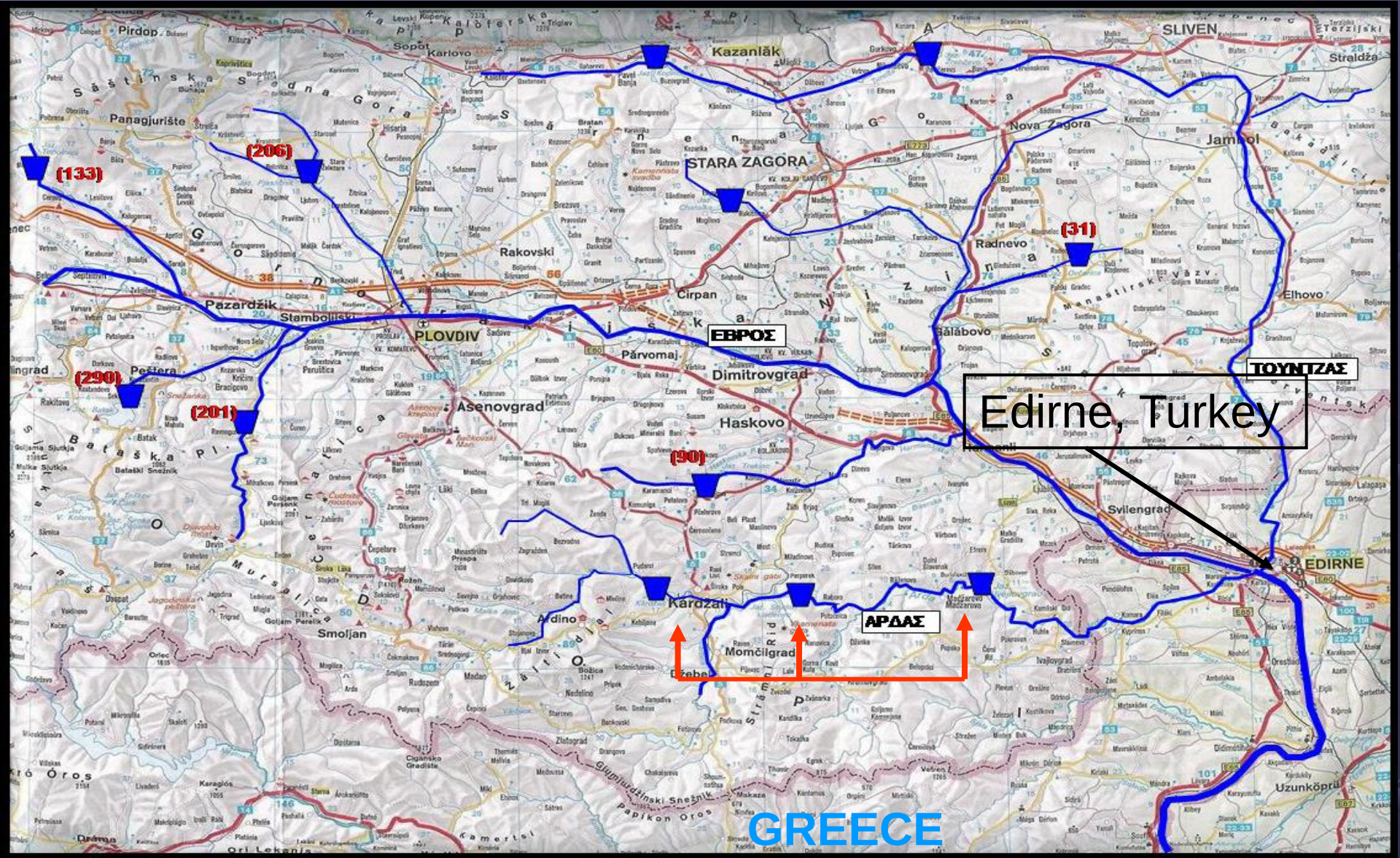
- ~15 large H/E D. constr. in the period 1950-70
- Their reservoirs control >38% of the Bulgarian part of the Transb. R. Basin of Evros/Maritsa/Meric system
- They **control ~all the water flow directed to down stream** part (Turkish & Greek) through the **trans. river system!**
- **privatization** in **1994**
- **Flooding** in down-stream part of basin (**Tr. & Gr.**), when flow, **Q>= 2.500 m3/sec**.
- **Impact on flood frequency**:

1. 1844-1995 (151 y.): 12 flood events, **Fr. <1 per 12 y.**
2. 1996-2013 (17y.): 9 flood events, **Fr. ~1 per 2y!!!**

Flood events in the Greek part of the transb. Evros/M./M. basin, between 2003-2012



Position of main H/E Dams in Bulgarian part of the transb. R. basin (the three in Ardas: critical for flood control downstream. Technical problems for proper operation)



Level of Cooperation among the 3 riparian countries for managing the flood problem

- A long record of BILATERAL official/unofficial initiatives: political/scientific meetings, negotiations, declarations. Few ineffective-inefficient agreements…
- NO TRIPARTITE cooperation and agreement.
- At present there exist 3 bilateral working teams exhibiting slow progress…
- Adequate cooperation among the 3 countries, only during crisis period (flood events)
- Each country has constructed & runs its own hydro-meteriological monitoring network (telemetric in recent decade). Use for flood forecasting and early warning purposes.

Greece: Network of 8 monitoring, telemetric stations (6 in 2008, 2 in 2013) for quantitative and qualitative hydro-meteorological parameters. Assistance for flood forecasting and early warning purposes.

CONTRIBUTION OF INTERREG III & PHARE TO FLOOD PREVENTION IN RIVER "EVROS", REGION OF EAST MACEDONIA – THRACE, GREECE

LOCATION 2
ORMENIO

LOCATION 1
KOMARA

LOCATION 4
ERYTHROPOTAMOS
(BJALA)

LOCATION 5
KIPOI

2013: 2 new telem. Stat.

LOCATION 3
PITHIO

LOCATION 06
DELTA

Current Flood Manag. status in the Evros/M/M Basin

Main facts:

- **Each** one of the 3 riparian countries is performing flood management in its own territory (i.e. part of the whole basin). **Bilateral** cooperation **ONLY** during flood **crisis** period
- Greece & Bulgaria are implementing the EU Flood manag. Directive 60/2007 which is consisting of three main stages: 1. f. hazard mapping, 2. f. risk mapping & 3. f. risk mitigation measures (a combinat. of “hard”-structural & “soft”-non stract. measures). They have finished stage 1 and have started implement. stage 2.
- All 3 countries are currently a. creating/improving their network regarding flood forecasting / early warning & preparedness systems. b. restoring/improving the damages/failures in the flood defense infrastructure (mainly the dikes system).

Prerequisites for an effective management of the flood problem: towards Integrated Flood Management (IFM)* according to EU Directive 60/2007

(*) max. benefits and min. losses from flooding.

A subsystem of Integrated Water Resources Management (IWRM), EU Directive 60/2000

- **AGREEMENT** of the 3 riparian countries for implementing IWRM & IFM of the WHOLE transboundary r. Evros/Maritsa/Meric basin.

The **Agreement** should be:

1. based on the UN (UNECE) "Water Convention" (for the Protection and Use of Transboundary Watercourses and International Lakes)

2. negotiated on an "ALL WIN" basis and the concept of "benefits and costs sharing" regarding the sustainable development of the transb. basin's water resources

3. establish, as a governing/administrative body of the r. Evros/Maritsa/Meric basin, the **International Commission** (political representatives) with scientific and administrative personnel. E.g. The cases of Danube and Rhine transb. R.

4. make **official** provision for structuring a **Master Plan** (through a committee of scientific experts representing the 3 riparian countries), based on the requirements of IWRM & IFM, provided by the engaged EU directives.

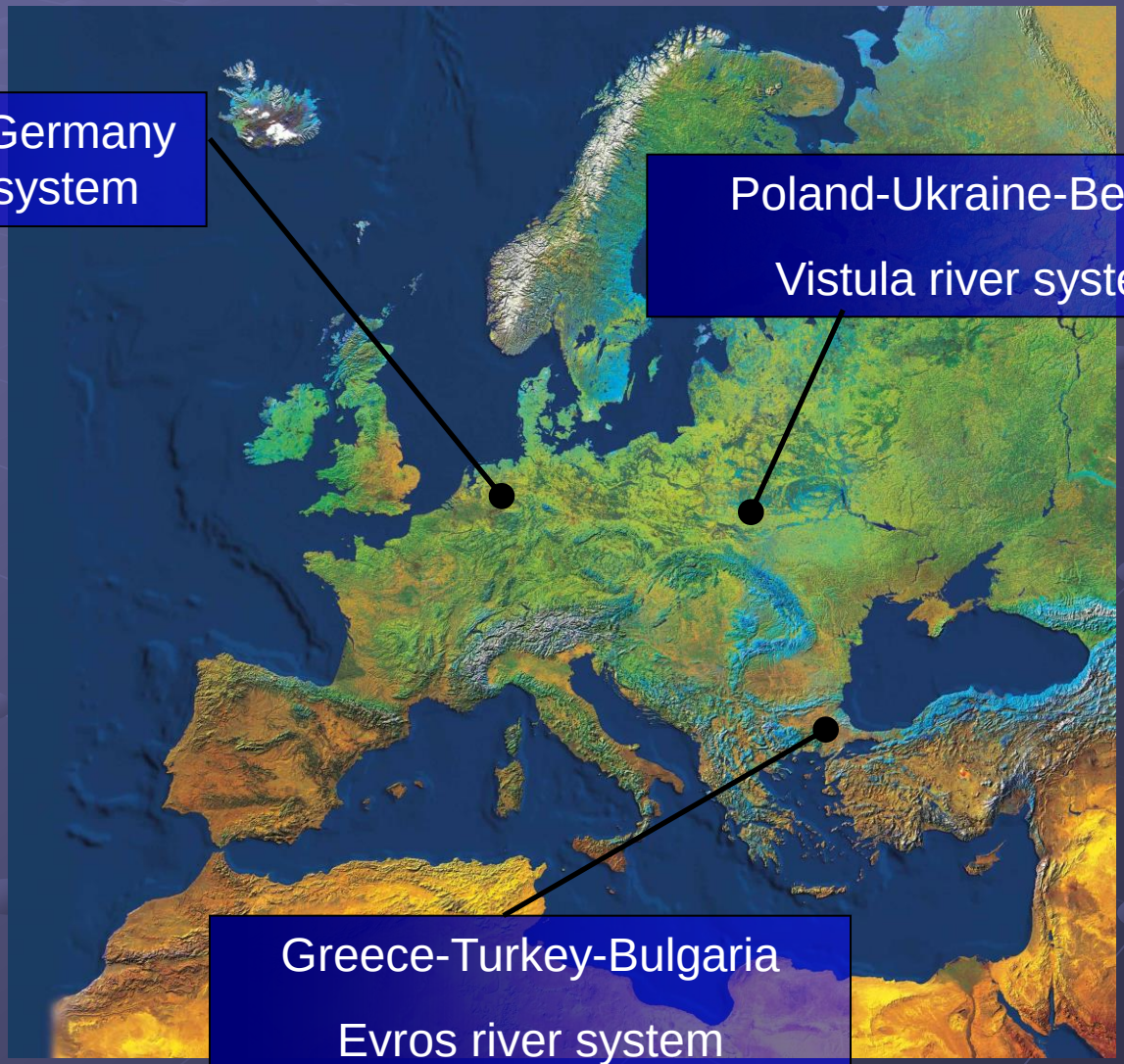
Critical remarks:

- Given the existing political and other **complexities-difficulties** regarding the status of each of the 3 countries and the old record of their cooperation initiatives, it seems **inevitable** for reaching a sustainable AGREEMENT the use of: ***Good services from a Third Party (reliable + capable) through effective incentives (positive, as the "carrot" & negative, as the "stick")!***
- **Bulgaria, as the ONLY up-stream country and covering the ~ 66% of the total transb. basin's area, has the key-role in this AGREEMENT!!**

Let me, thank you all for your kind attention!

Stelios Skias

Three flooding case-studies in three cross border river basins



The case-study presented by the Greek partner (Euroregion):

Flood management in the transboundary Evros/Maritsa/Meric River Basin

Last Floods: March 2006 (satellite picture: 20/03/06)

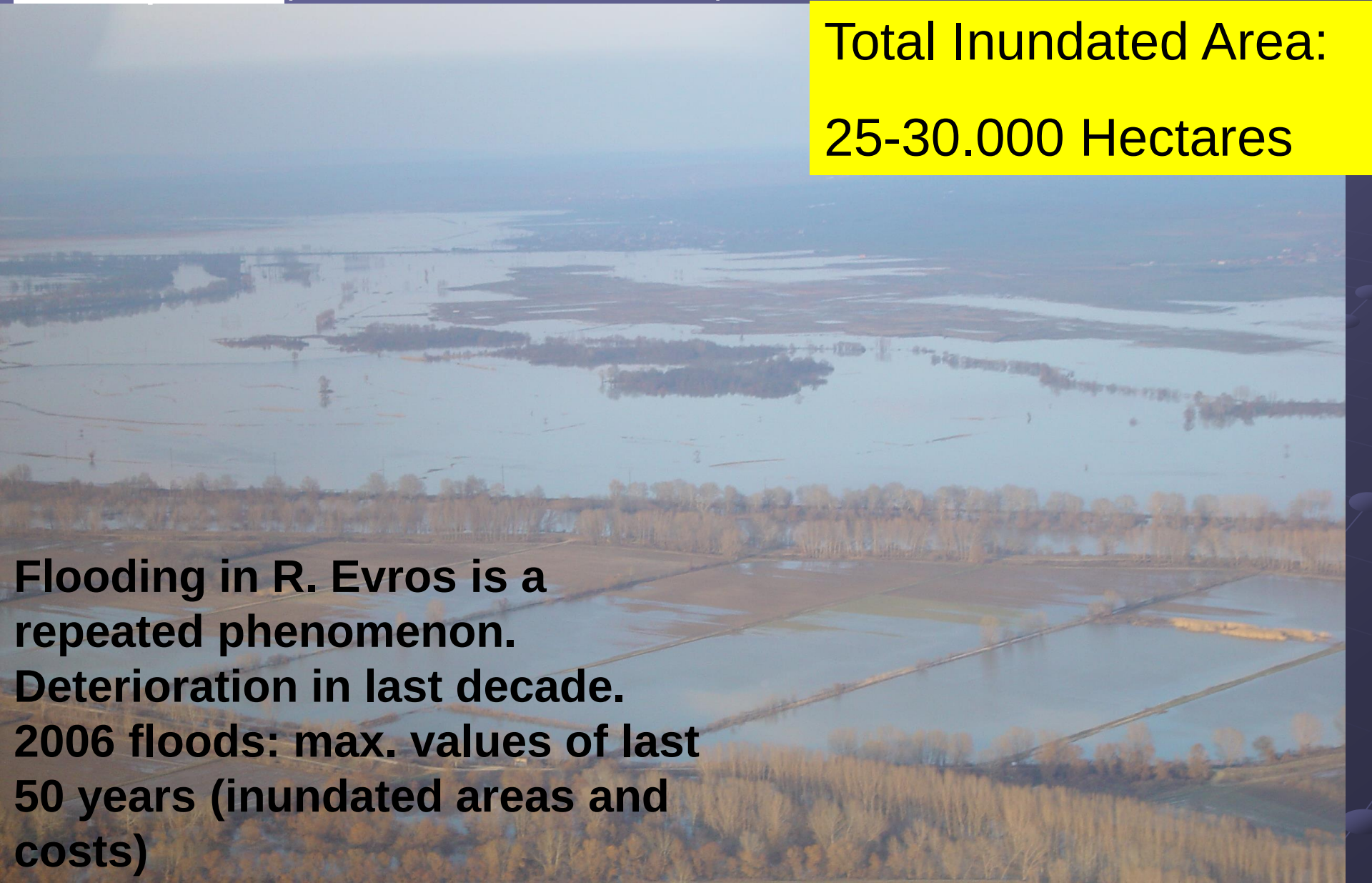
Floods 2006, “Lavara” riparian Village, Evros Prefecture, GR

Several tens of houses have been evacuated

Floods 2006: inundated agricultural fields in Evros River flood plains, Evros Prefecture, GR

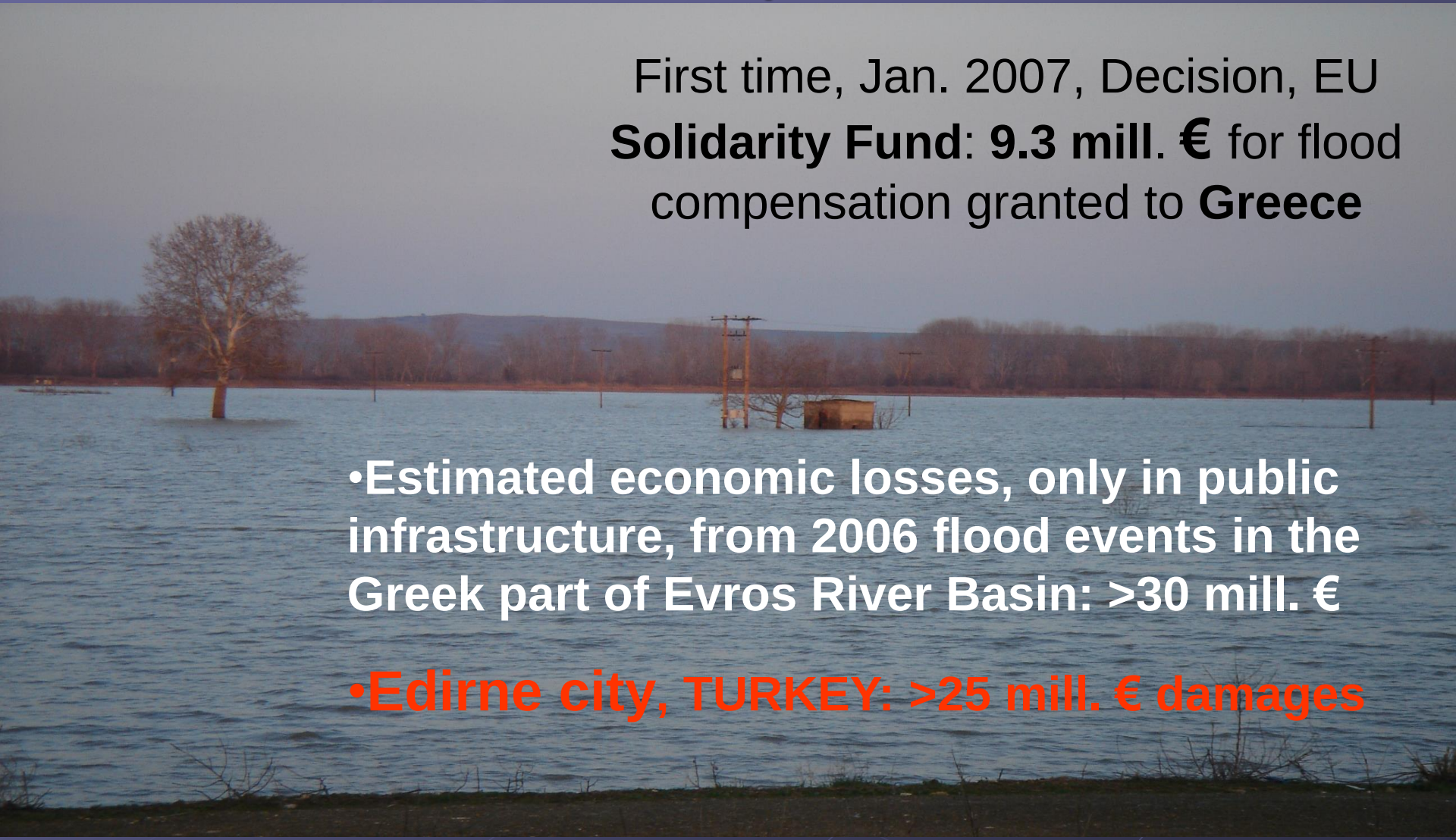
Total Inundated Area:

25-30.000 Hectares



Flooding in R. Evros is a repeated phenomenon. Deterioration in last decade. 2006 floods: max. values of last 50 years (inundated areas and costs)

R. Evros: Floods 2005 and 2006, the same picture!!



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- **Edirne city, TURKEY: >25 mill. € damages**

Floods 2005

(From Stefan Modev, Assoc. Prof. & Silvia Kirilova, UACG – Sofia, Alex/poli 17 – 19, May, 2006)

Edirne, Turkey March 2005

Floods 2005

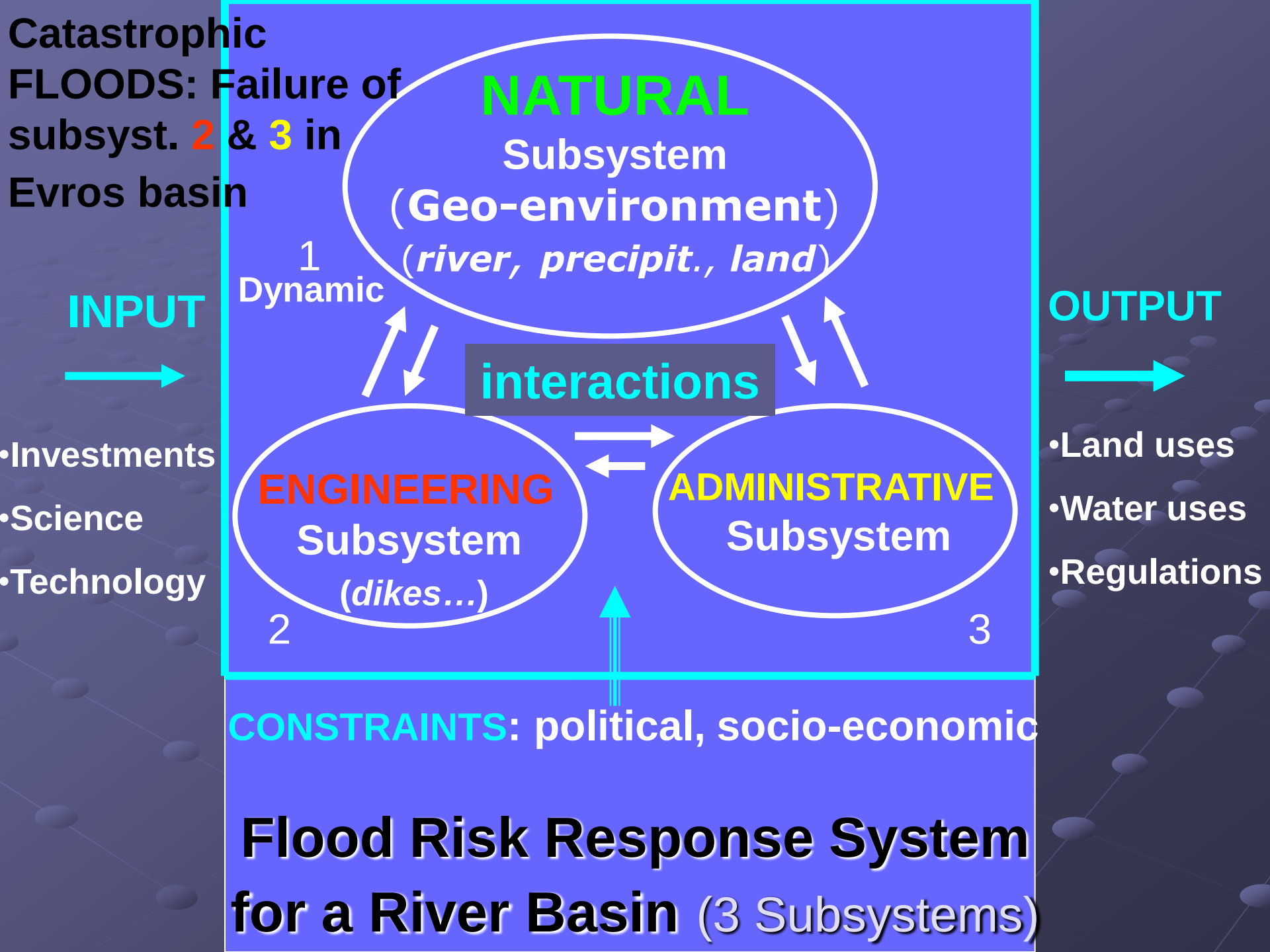
(From D.S.I. – Edirne, Turkey, 14 September, 2005)

Causes of flooding in Evros Basin:

1. **Natural origin (one or combined causes)**: **-** extr.precipitation mostly in upstream parts (mainly in Bul., less in Turk.), **-**extr.temp. variability /anomalies in time and space (result: rapid snow melt, mainly upstream),**-**sand/plants accumulation in river bed (channel capacity decrease), low gradient downstream
2. **Human negative interventions: a) direct**, as flood defense measures: **dikes** and **dams** (allocation, design construction and operation) and reduction-elimination of natural **flood plains** of the river system (EVROS case), *b) indirect : as through CO2 accel. greenhouse effect, thus cussing climate change* **Climate Change:** more often weather extr., thus more often floods and droughts are expected!!

Axioms: 1.**abs. flooding safety is a myth, 2. abs. protection**: **neither technically feasible nor economically or environmentally viable**

Catastrophic FLOODS: Failure of subsyst. 2 & 3 in Evros basin



Flood Risk Response System for a River Basin (3 Subsystems)

R. Evros Basin: No proper synergy and cooperation among stakeholders within each country, neither among the three neighboring countries. **Hence, no IWRM up to present**

Flooding in Evros basin:

Results of cooperation among GR-BL-TR (only bilateral) up to recently (2005)

- **Main tangible results within the last decades:** Borderline fixing (sev. decades ago) through land-exchange and river course regulation/alignment). Then, only unilateral updating and other technical actions on river banks (construction of groins, etc)
- Bilateral goverm. Agreements and Declarations on irrigation water release quant. (Bul-Gr), environm. protection and flood crisis coop. Mostly: generalities, no follow-up, verbal support for joint efforts/actions
- Local neighboring governments networks (Prefectures and Municipalities), in recent years. Cooperation on floods mainly during crisis situations (humanitarian issues, civil protection measures)

Causes for the low/poor level of cooperation results regarding the cross border Water M. issues/problems (as flooding) in R. Evros B.

- Basic Differences in: political regimes, strategy priorities, water policies, political and legal culture, human and financial resources, natural setting (upstream or downstream position)
- Lack of mutual **confidence** and **trust** due to above differ., + histor. events (conflicts, wars)
- **centralized** decision making, **fragmentation** in competent authorities, **often changes** in foreign and domestic* (water issues*) policies.
- No use of **SUSTAINABILITY** Principles as driving force and policy shaping criteria. No integrat.manag.
- **Different** relations with **EU** (**Implem. of Directives**, participation in Programmes, etc)

Recent promising steps on flood protection

- **Trilateral inter-governmental cooperation:**

  working group: state officials, coordinated by diplomats. Two meetings, since May '06, 3rd expected...(?) *First issue: technical agreement over storage levels and max. water flow releases from Bulgarian dams (Ardas river). Bulgaria argues the capability of controlling its H/E dams and the responsibility of Turkey and Greece in keeping max. channel water capacity by technical interventions (trees and sand removal) ……*

- Bilateral techn. co-operation (GREECE-TURKEY)

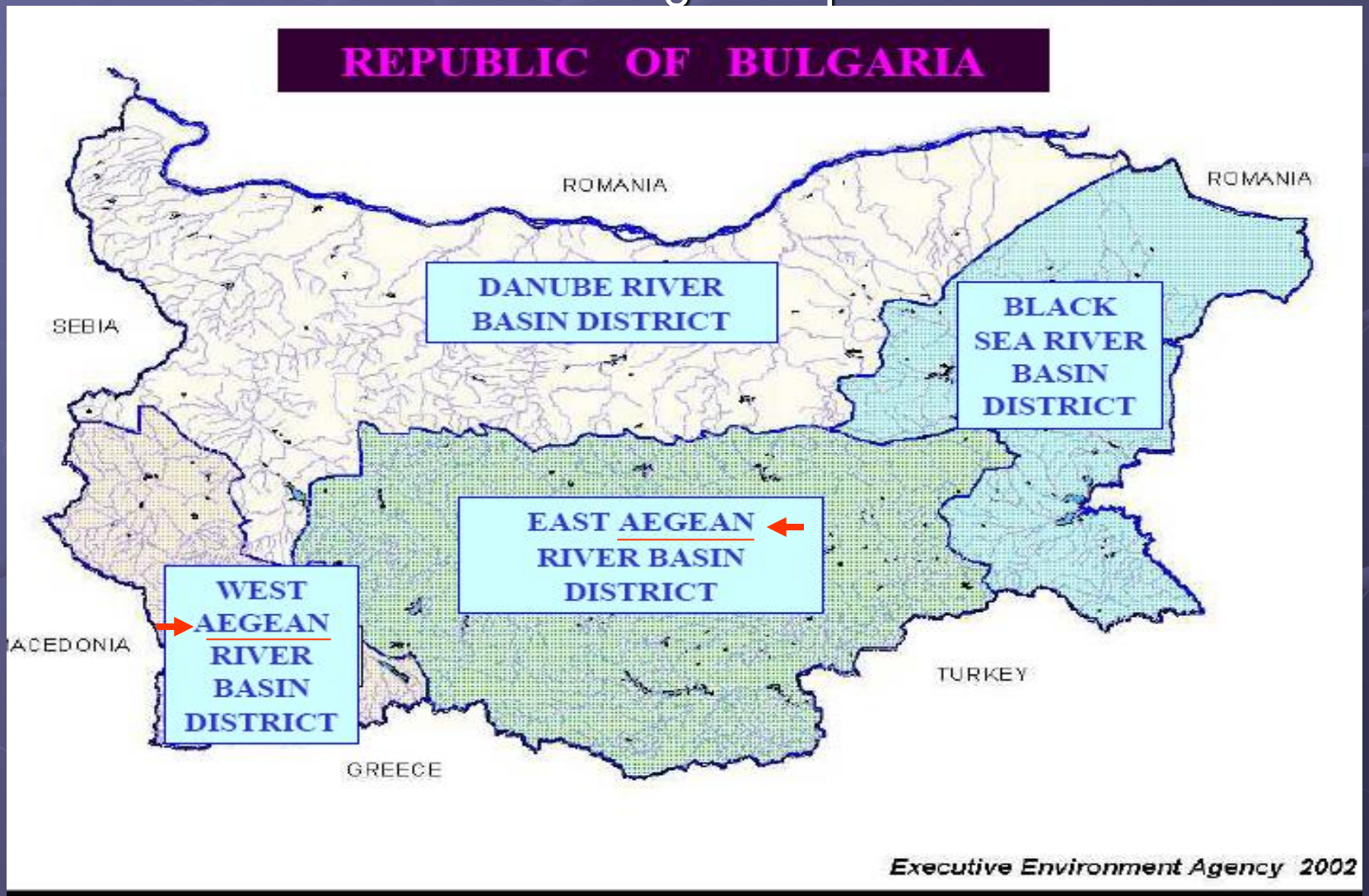
  working group: two recent meetings on engin. measures to increase flow in comm. part of r. Evros bed (elimination of trees in r. bed): flood mitigation in certain riparian areas, mainly Edirne city. Technical Protocol has been signed. Works are expected

- **Underway**: agreed installation of automated river monitoring stations in GR (6), BL and TR engaged to a **European Flood Alert System (EFAS)** financed through INTERREG and PHARE, *EU funding*). **Steps in Implementing WFD 60/2000….**

Bulgaria: map presenting spatial allocation of the **four**

Water Districts (implementation of EU Directive 60/2000)

The name AEGEAN is considered by Greece as a new "hot spot" for current Greek-Bulgarian political relations



Integrated Flood Management (IFM)

(The scientific background of the EU new Flood Directive)

- **IFM Definition (2003)**: a process integrating **land and water resources** development in a river basin level, within the context of **IWRM**, and manage floods based on **risk management** principles in order (**AIM**) to: **optimize** the net **benefits** from **flood plains** while **minimizing** the **loss** of **life** and **property** from flooding. **Implementation**: through the EU F. Directive

- **IFM PLAN: should address 5 Key-elements**
  - Manage the water cycle as a **whole**
  - Integrate LAND and WATER in the whole R. Basin
  - Adopt best mix of strategies (tailored to spec Basin)
  - Ensure participatory / interdisciplinary approach
  - Adopt integrated risk management approaches

Critical view points

- **Flood Risk is entirely a human concern!**

- **Flood mitigation strategic goal**: taking advantage of existing benefits (regular floods) and preventing flood events from becoming disasters

Best flood mitigation practice:

5 Element **Strategy**

(***in order of importance***):

1. **Prevention**
2. **Protection**
3. **Preparedness**
4. **Emergency response**
5. **Recovery and lessons learnt**

1. Prevention: by appropriate, case specific, land-use, agricultural and forestry practices, flood plain zoning and regulation, development and re-development policies, preserving val. ecosystems (wetlands, river Deltas) housing and industry building codes, flood-proofing, flood forecasting and warning

2. Protection: by taking optimal mixture of necessary, well designed structural measures allocated in specific parts / points of he River Basin (dikes, flood embankments, retention ponds, dams-reservoirs, catchment management, channel improvements, etc).

Remark: *Initially, multi-criteria analysis for the flood defence measures in order to prove their effectiveness*

3. Preparedness: **Informing** People ("what to do - how to react", based on flood risk maps) and **Educating** (specific for different society groups)

4. Emergency response: developing and regularly updating emergency response plans

5. Recovery and lessons learnt: returning to normal conditions as soon as possible and mitigating both social and economic impacts on affected population and districts

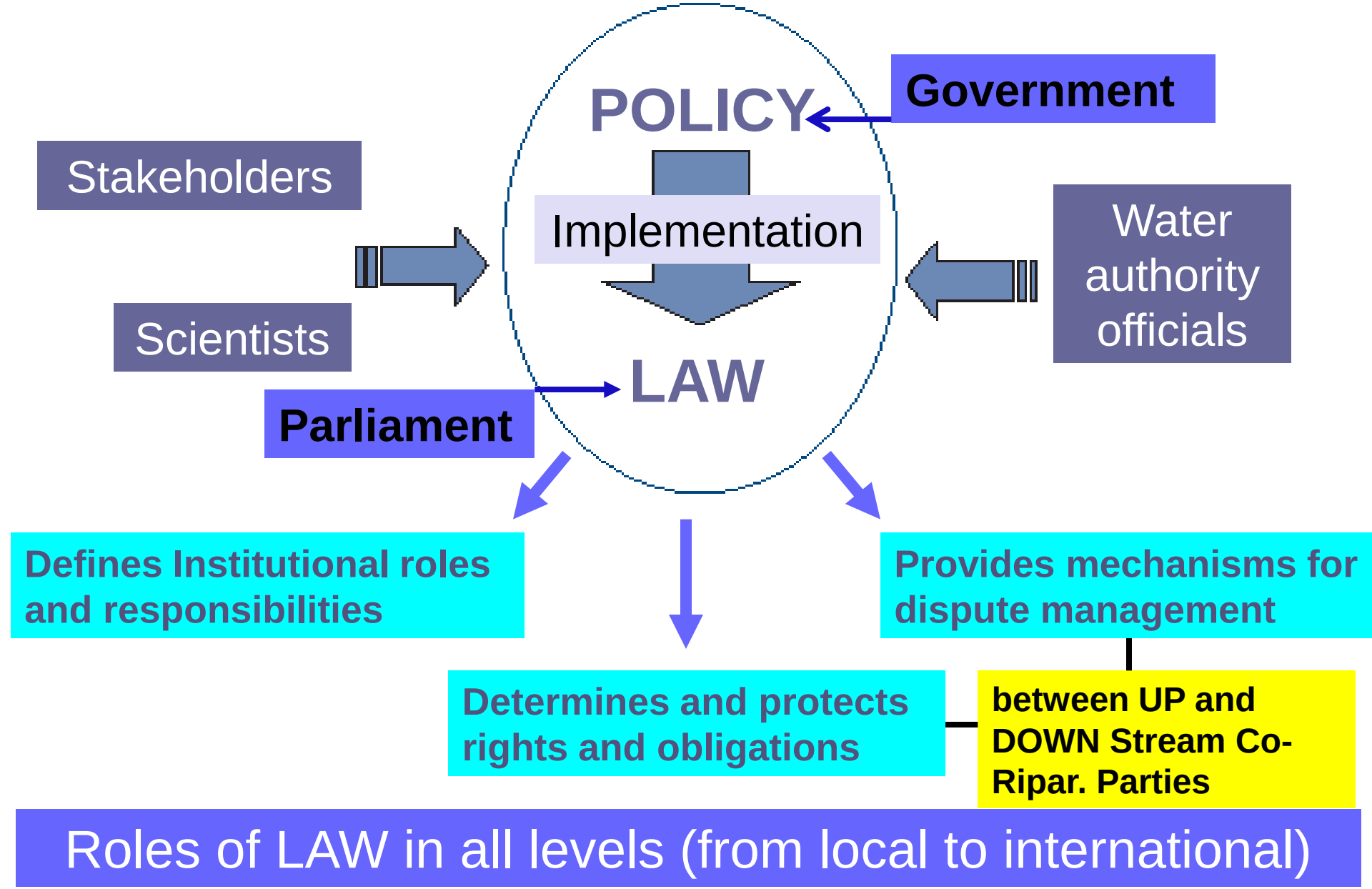
Putting IFM into Practice:

It needs strong commitment for clear and objective policies supported by effective Legislation and Regulations ("fit to the case") at local up to international level

Law, as the vehicle for the orderly, time consuming, change, towards implementing IFM, must ensure :

- **Coordination and cooperation among various disciplines, government depts and sectors of society**
- **Synergy between the actions of various stakeholders**
- **The rule of equitable and reasonable use of w. recourses**
- **Reconciliation mechanisms of conflicting interests**
- **Procedural rules for data-exchange and information**
- **Effective mechanisms for public participation**
- **Provisions for establishing Joint commissions and their coordinating roles**

The **International Law Association (ILA)** provide useful **guidelines** for implementing **IWRM** in **SHEARED** River Basins.



Conclusive comments for the IFM

- There is a worldwide paradigm shift from **"flood defence and control to flood preventive management, through IFM implementation"**
- **Not expect quick victories. But there is no other alternative!**
- No single solution for every case.
- The R. Basin should be considered as a unit for management, taken into account scale differences.
- **It will cost more before it will cost less! But this is the only way to break a vicious cycle!**
- Responses should be oriented to help affected populations restart (perhaps new) productive activities, instead of only providing temporary aid!

Co-op on river Evros B. management and flood protection: The way ahead

- **Urgent priority for short-term solutions on acute flooding problems**

-**Trilateral Technical Agreement, mainly, for**:

River flow regime (max. Q) and engaged to it H/E Bulg. Dams Operation (as 3 on Ardas r.) during floods.

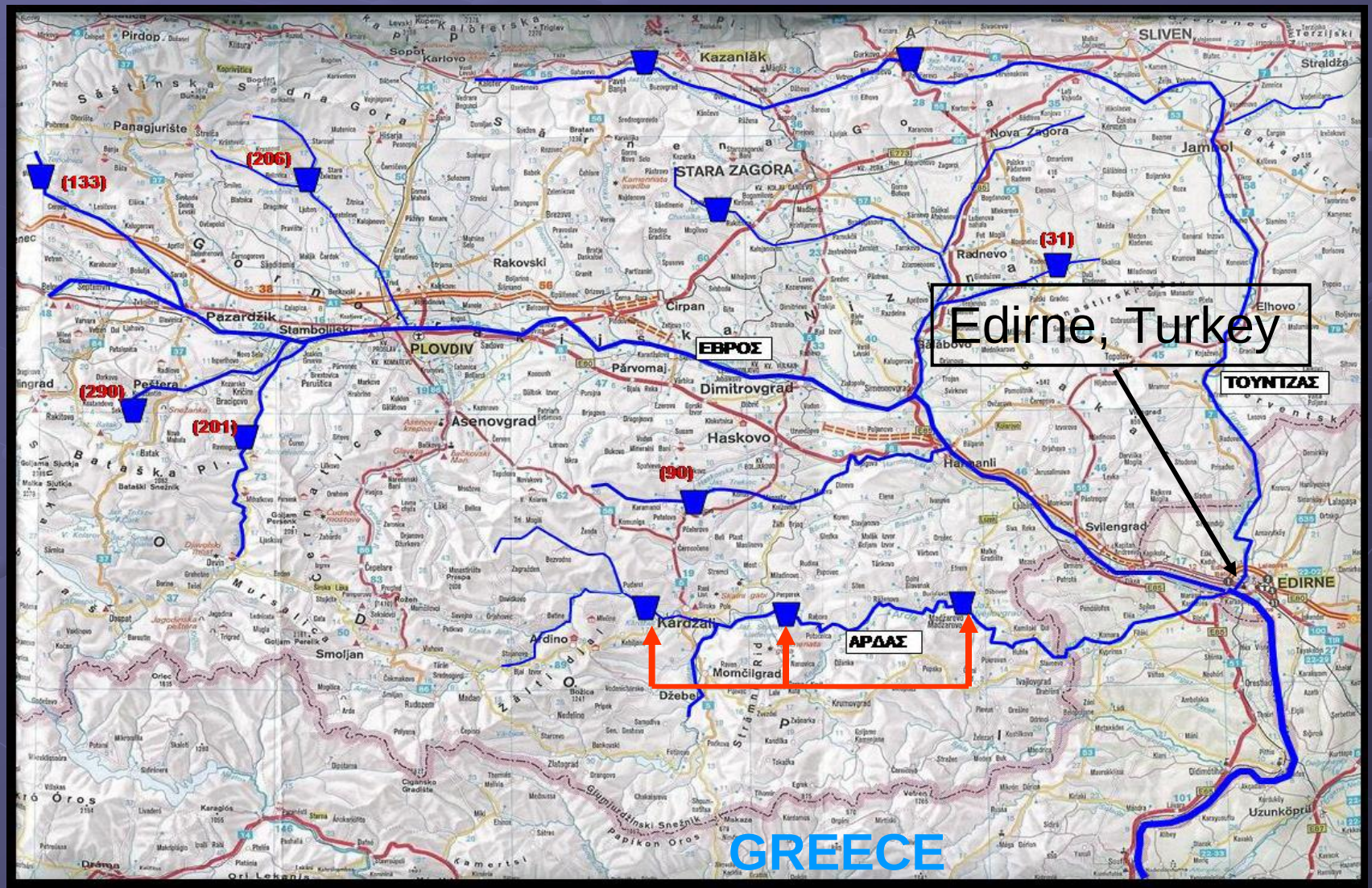
Updating / reconstruction of existing flood protection structures-measures (dams, dikes, river beds, flood plains, etc). **Critical issue: Cost sharing criteria…**

Coop status (protocol) on crisis situations (local officials)

-Exchange of existing DATA related to water management (incl. flood protection), through offic. appointed scientific personnel (establishment of trilateral expert teams). Common scientif. projects

-Allocation of natural areas on existing flood plains, as retention ponds / lakes, for the excess flood-waters

Position of main H/E Dams in Bulgarian part of R. Evros Basin (the three in Ardas: critical for flood control downstream. Technical problems for proper operation)



Urgent priorities for LONG-term solutions

- Trilateral Commission (standards as in Rhine River) for Integrated Management (land and water) of the WHOLE River Evros Basin. Agreement on a sustainable and long-term basis ACTION PLAN (with well defined tasks!)
- Sound implementation of EU Directives as mainly WFD, Flood and others (legislation, monitoring, data banks). Driving Principle: "more room to river"
- Reconsideration of spatial planning and land-use in Flood Plains (differ. criteria according to the distance from the river)

Final comments and a proposal

In our border regions, Greece, Bulgaria and Turkey are sharing extremely valuable water resources (surface + g. water) manifested by the water system of the cross border river Evros

Thus, the three countries (the two full members of EU!!), must work hard and invest adequate human and financial resources for an Integrated Water Management, permanently oriented towards maximizing the related to it Public Goods, in these regions. Existing examples of relevant good practice must be considered.

The most valuable Public Goods, directly engaged to Sustainable Development in our border regions, and controlled be the Water Resources Management, are:

- **Flood* and Drought* protection (* Water Q. extremes which must undergone common management)**
- **Biodiversity, and**
- **Water Quality**

All regional policies and action plans regarding Energy, Wastes, Agriculture and Tourism (among others) must have as their first priority the Optimization of above Public Goods. Since, they are controlling the fundamental human rights for:

Quality of life, Prosperity, Peace and Stability in our Regions.

A comment about “cost and benefit”

The financial and other costs for implementing a sound Water Management action/project (engaged to a Consensus among Stakeholders), must be paid justifiably, by those who gain the benefit of it, irrespectively from the place* of its realization (upstream or downstream side)

***e.g. Bulgaria (upstream side) qualify to come up with this principle relatively to existing or new water retaining structures for flood control in the framework of an IWRM regarding the river Evros basin**

The process towards structuring optimum (“all win”) Integrated Water Res. Manag. and the creation of engaged to it Action Plans in the case of r. Evros transboundary basin, can be greatly facilitated by Third Party involvement (law process: ***Arbitration)***.

Such an advising/organizing and problem solving role may well be played by an experienced, internationally respected, non profit, organization as the Stockholm International Water Institute (SIWI), Delft Hydraulics and other Institutions (e.g. Universities as that of Nijmegen).

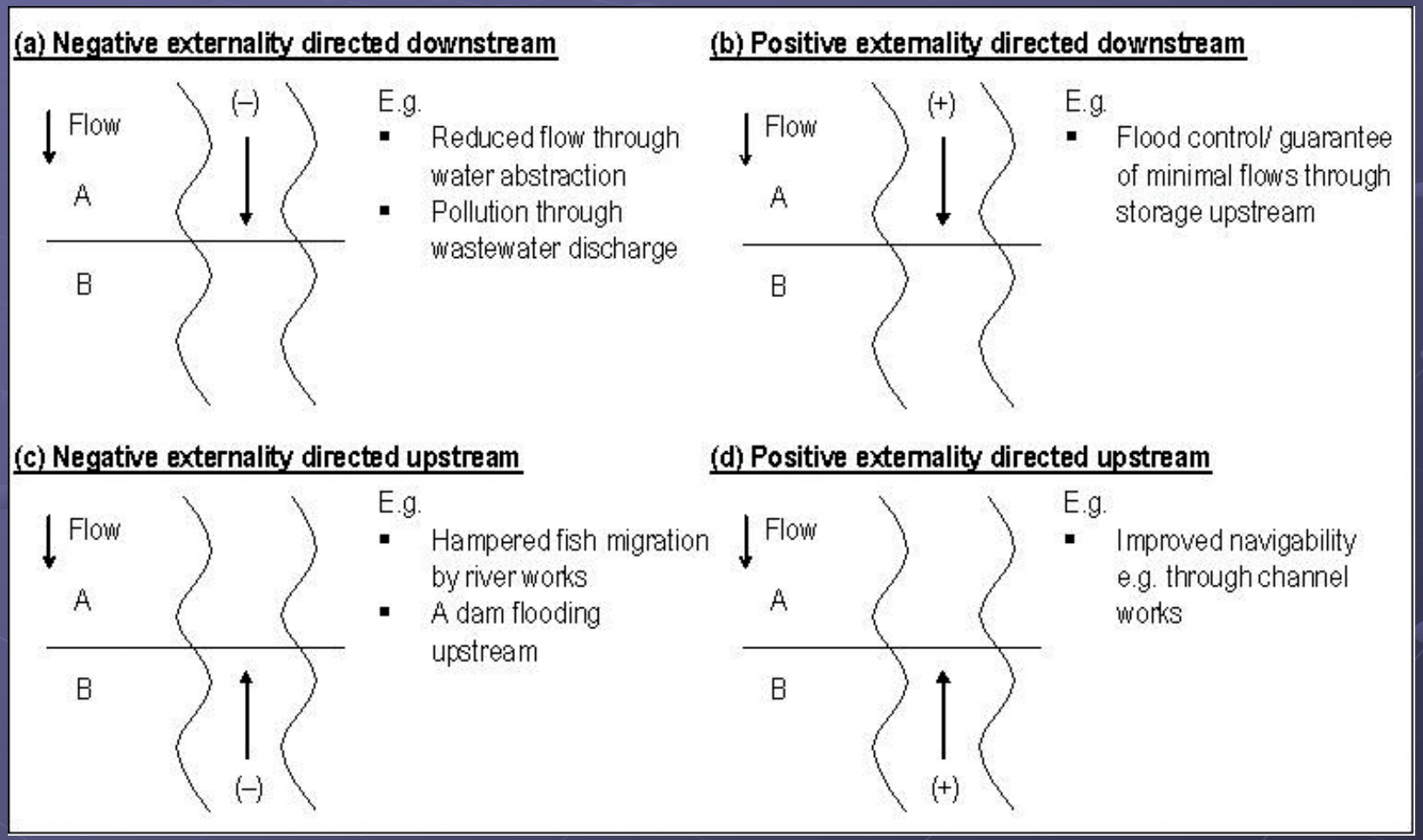
IWRM

The Integrated Water Resources Management (IWRM) paradigm has been worldwide recognized as the only feasible way currently available to ensure a sustainable perspective in planning and managing water resource systems. It is the inspiring principle of the Water Framework Directive, adopted by the European Union in 2000, as well as the main reference for all the water related activity of UNESCO in the third world countries.

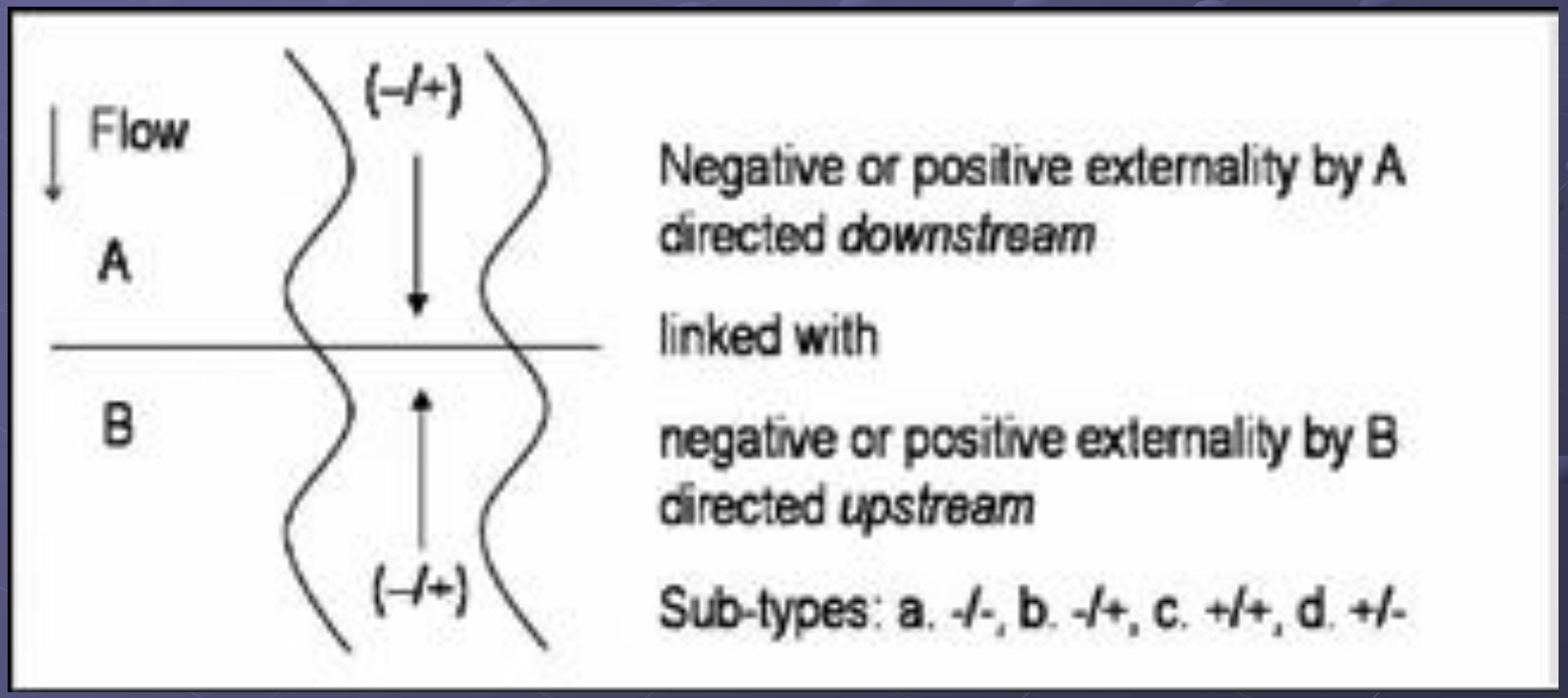
However, very often, real world attempts of implementing IWRM fail for the lack of a systematic approach and the inadequacy of tools and techniques adopted to address the intrinsically complex nature of water systems

Βλ. βιβλιο Topics on System analysis and IWRM, Elsevier, 2007, Edit. A. Castelletti & R. Soncini-Sessa

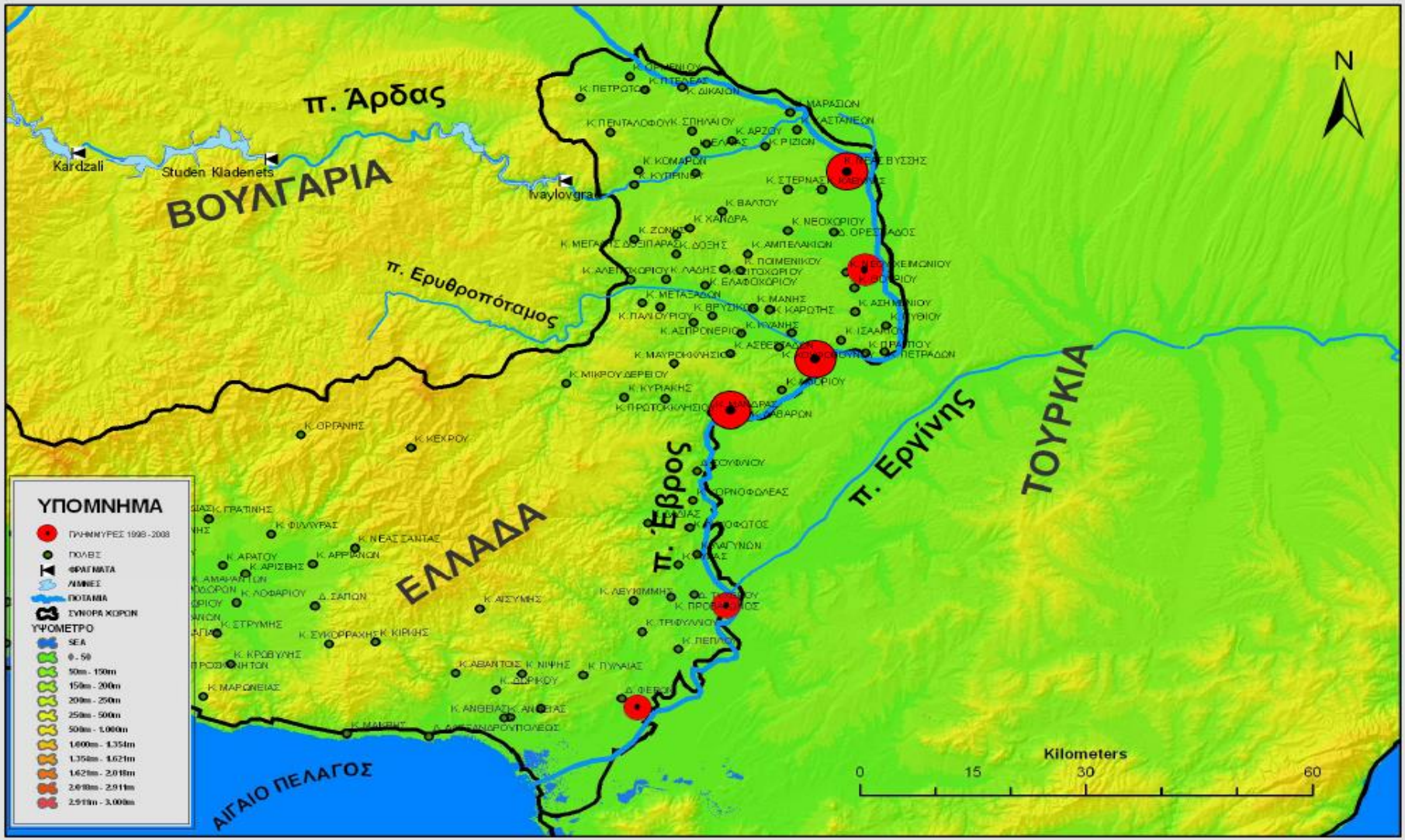
Typology of externality problems in the use of transboundary rivers
Source: Dombrowsky (2010b)



Linking water uses with effects in reversed directions (type 1 intra-water sector linkage)
Source: Dombrowsky (2010a: 136),g

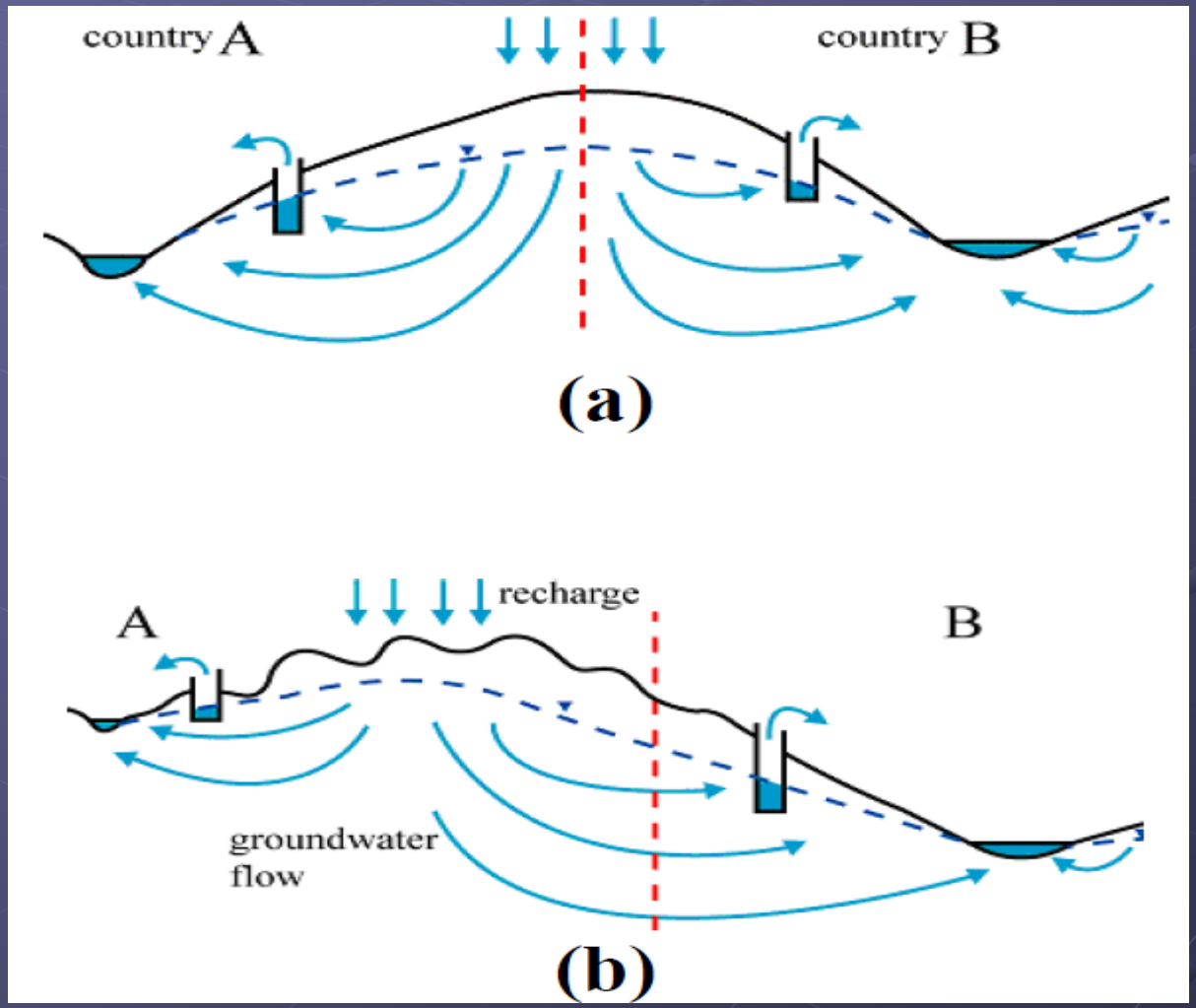


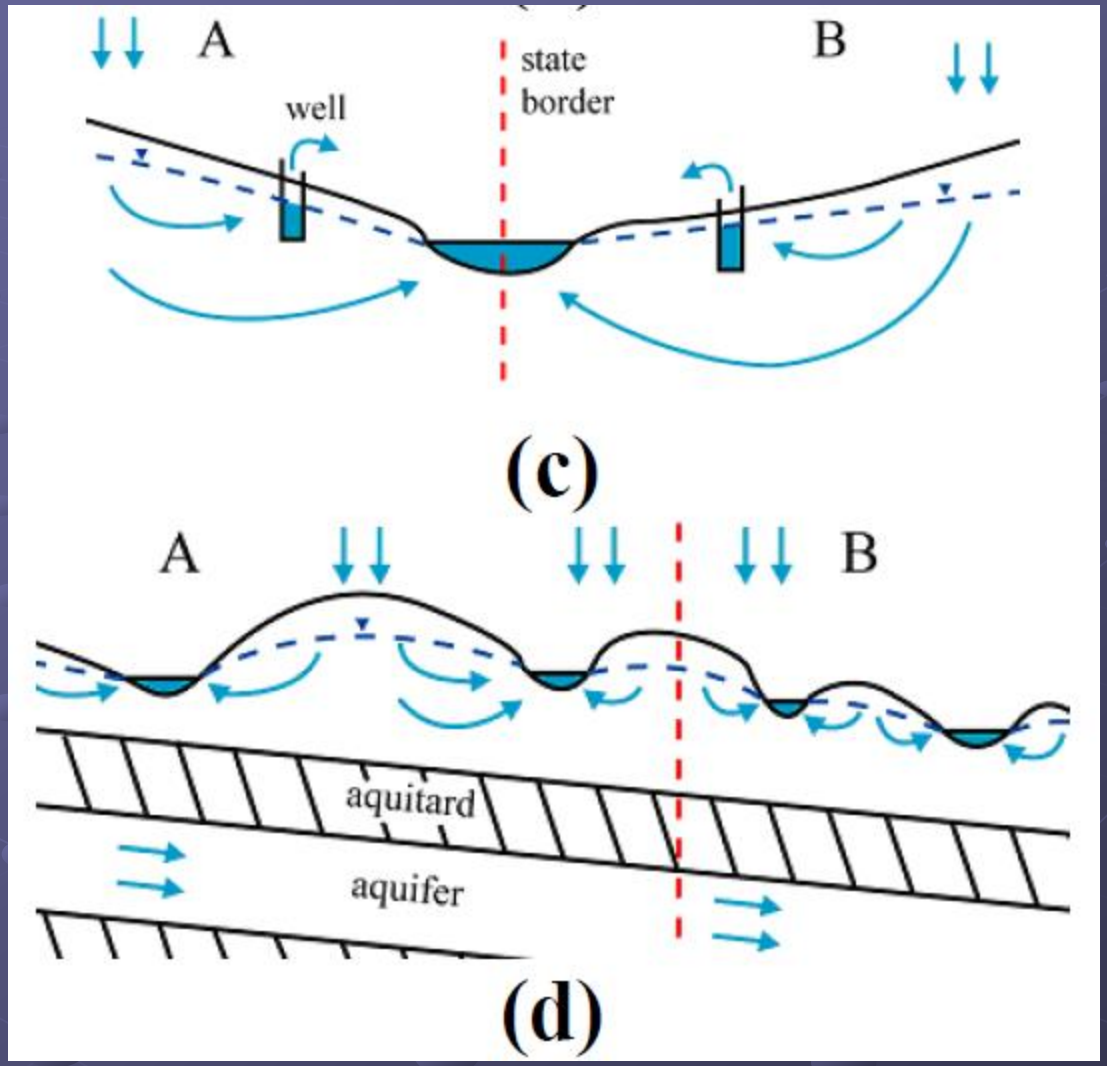
Flood events between 1998-present



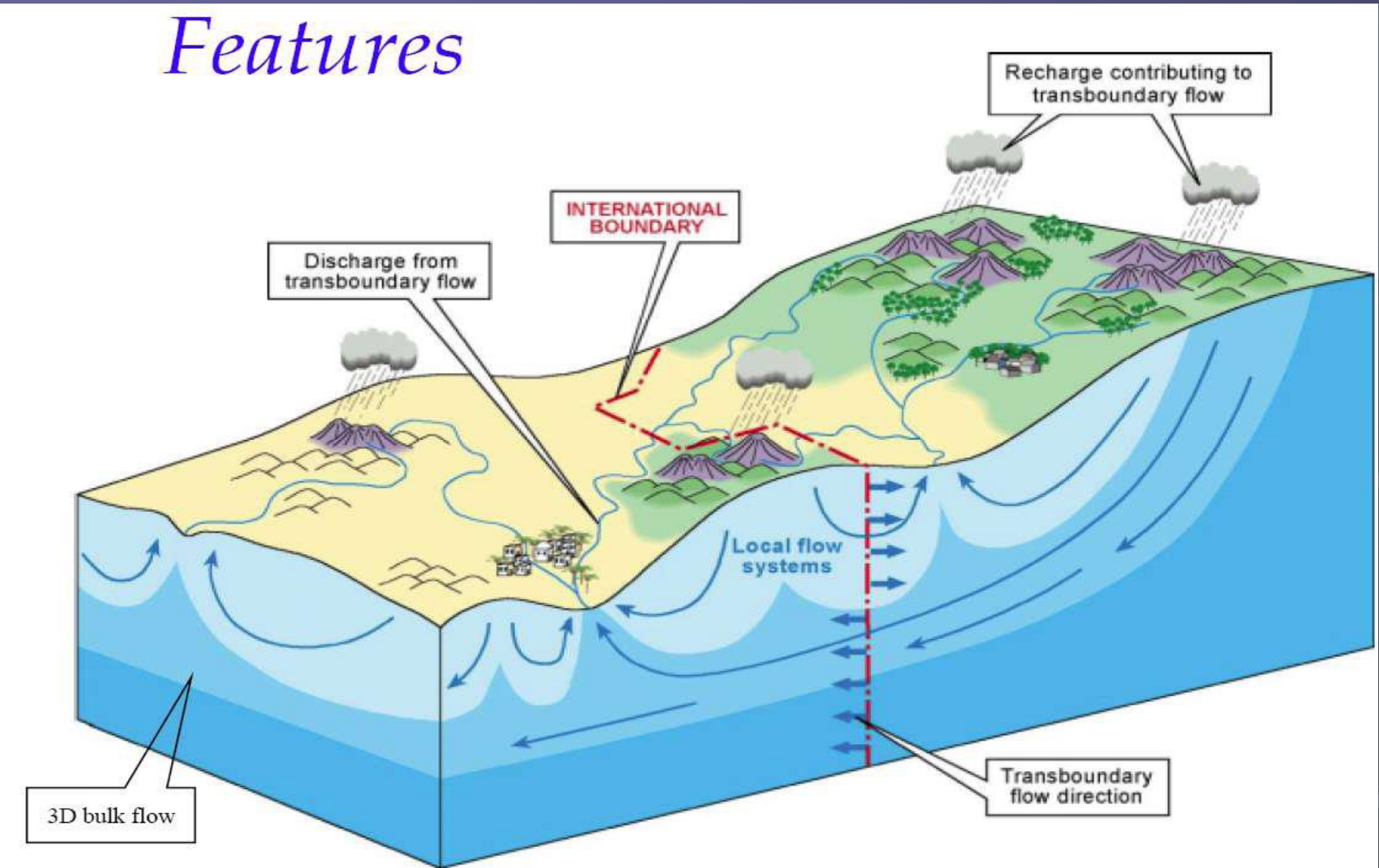
- ***Capacity-building and training on both the technical and decision-making issues/levels could help improving both the knowledge base and effectiveness of international cooperation.***

Types of transboundary sedimentary aquifers (Chilton, 2007).

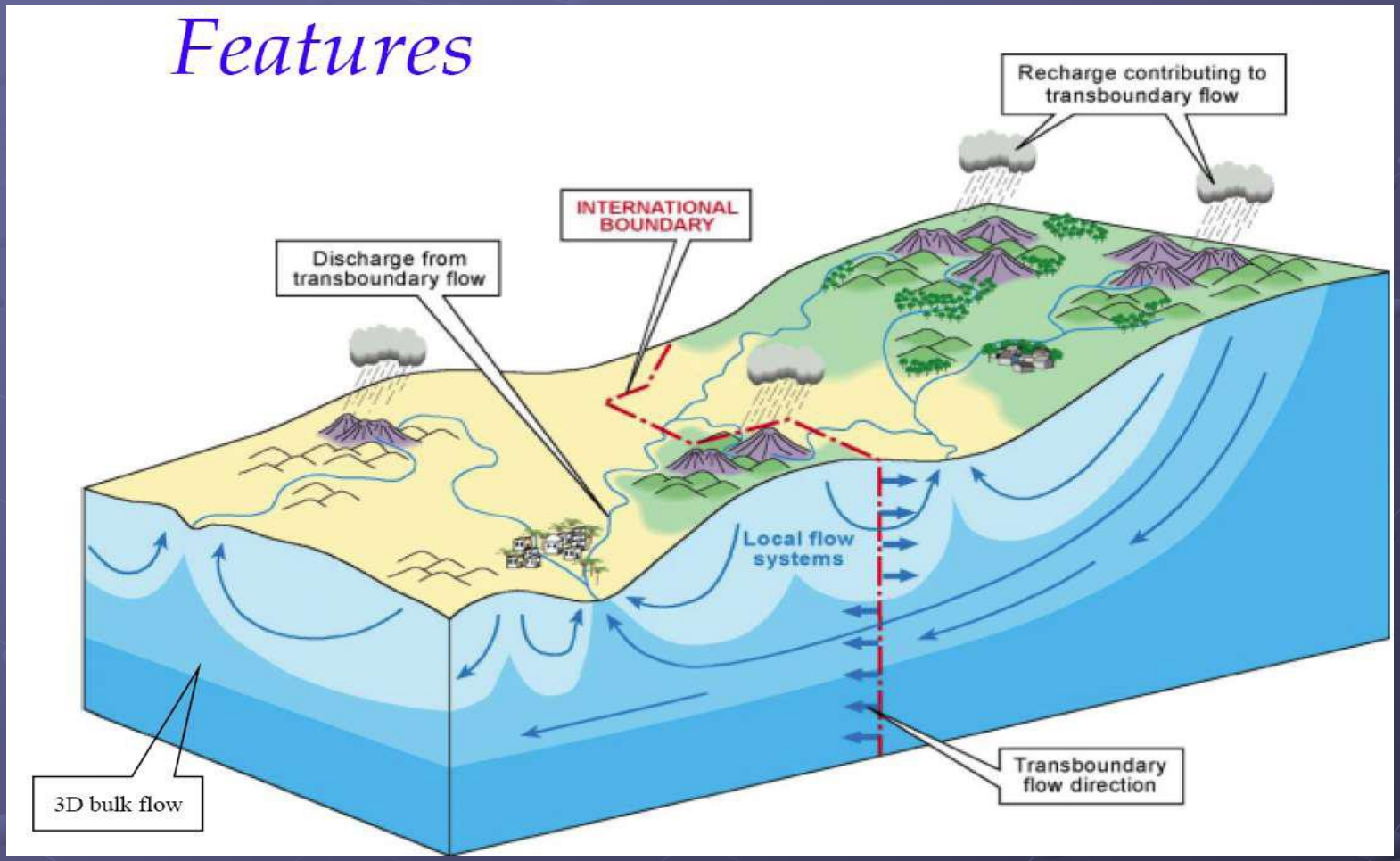



A
B
state
border
well
(c)
A
B
aquitard
aquifer
(d)

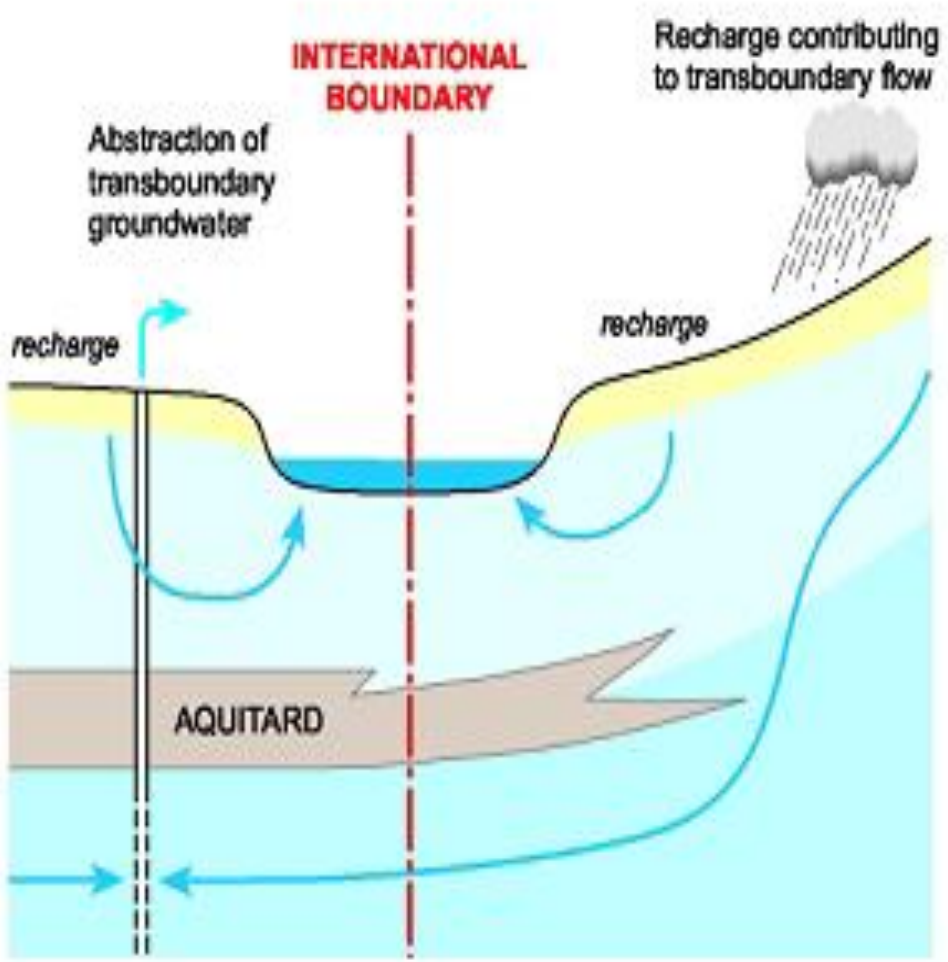
Schematic representation of hydrological and hydrogeological processes in transboundary areas *(UNESCO/ISARM, 2001).*



Features

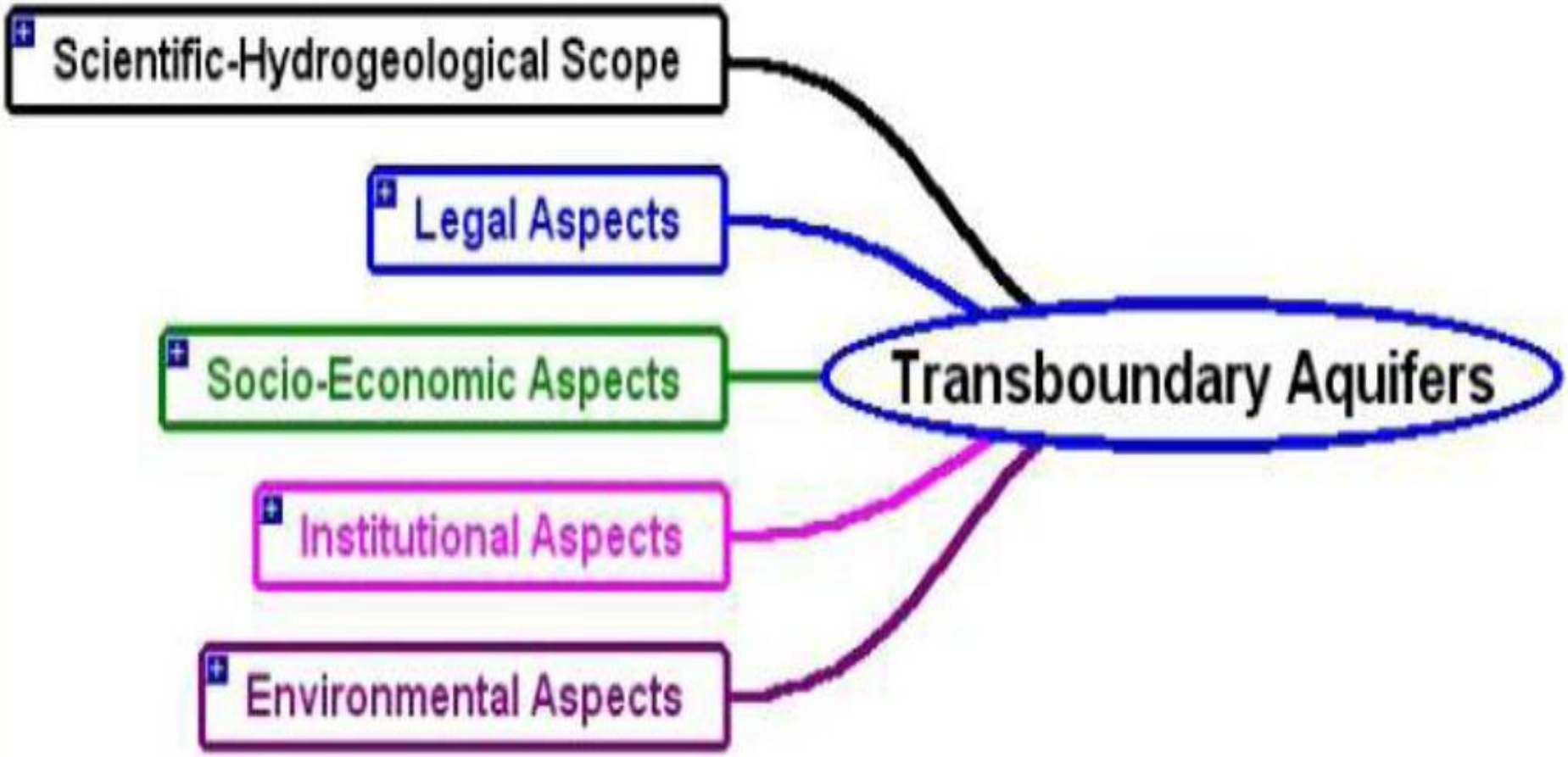

Recharge contributing to transboundary flow
INTERNATIONAL BOUNDARY
Discharge from transboundary flow
Local flow systems
3D bulk flow
Transboundary flow direction

Interaction between surface and groundwater flows near an interstate boundary
(UNESCO/ISARM, 2001).

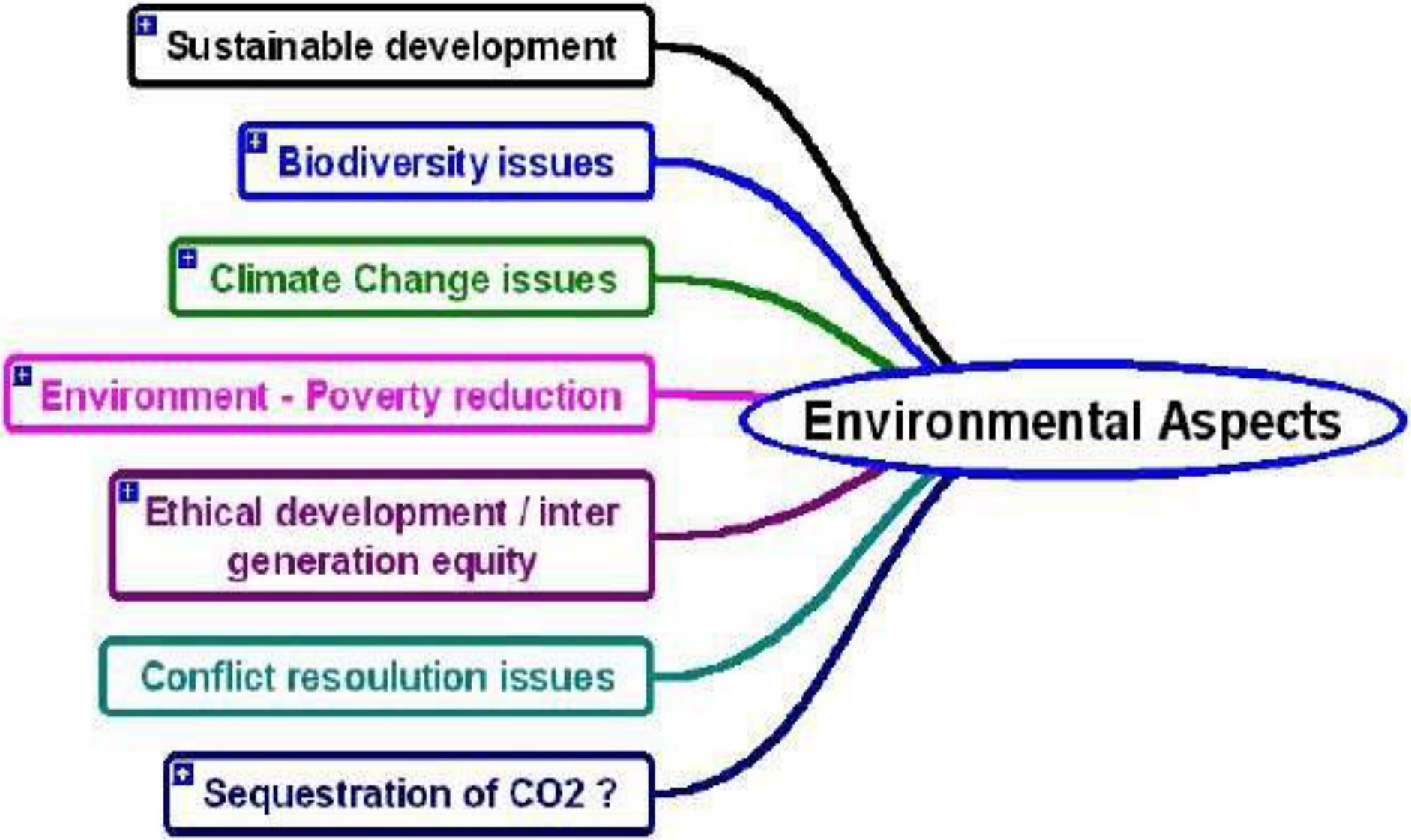


The ISARM Programme:

Multi disciplinary integrated approach



Environmental aspects



3 Transboundary Aquifers (inside red line) alluvium (blue color) & karstic (green) within the River Evros/Maritsa/Meric Basin

Transboundary Water Resources Treaties: what is regulated? (145 most recent treaties)

- Information sharing 64%
- Monitoring 54%
- Conflict resolution 46%
- Water allocation 37%
- Enforcement 19%
- Water use focus – water supply 37%
- hydropower 39%
- flood control 9%
- others 15%

Thank you for your kind attention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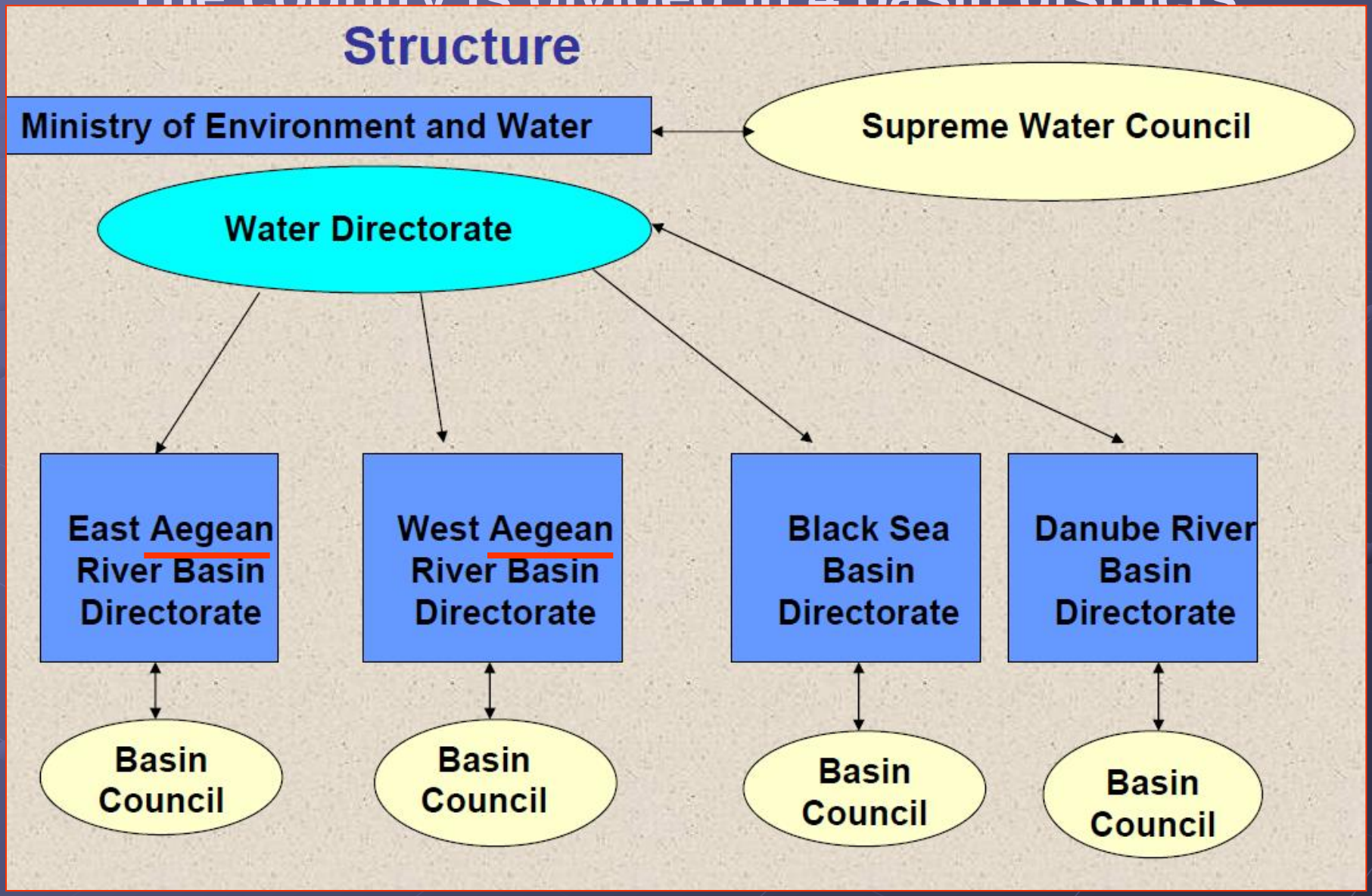
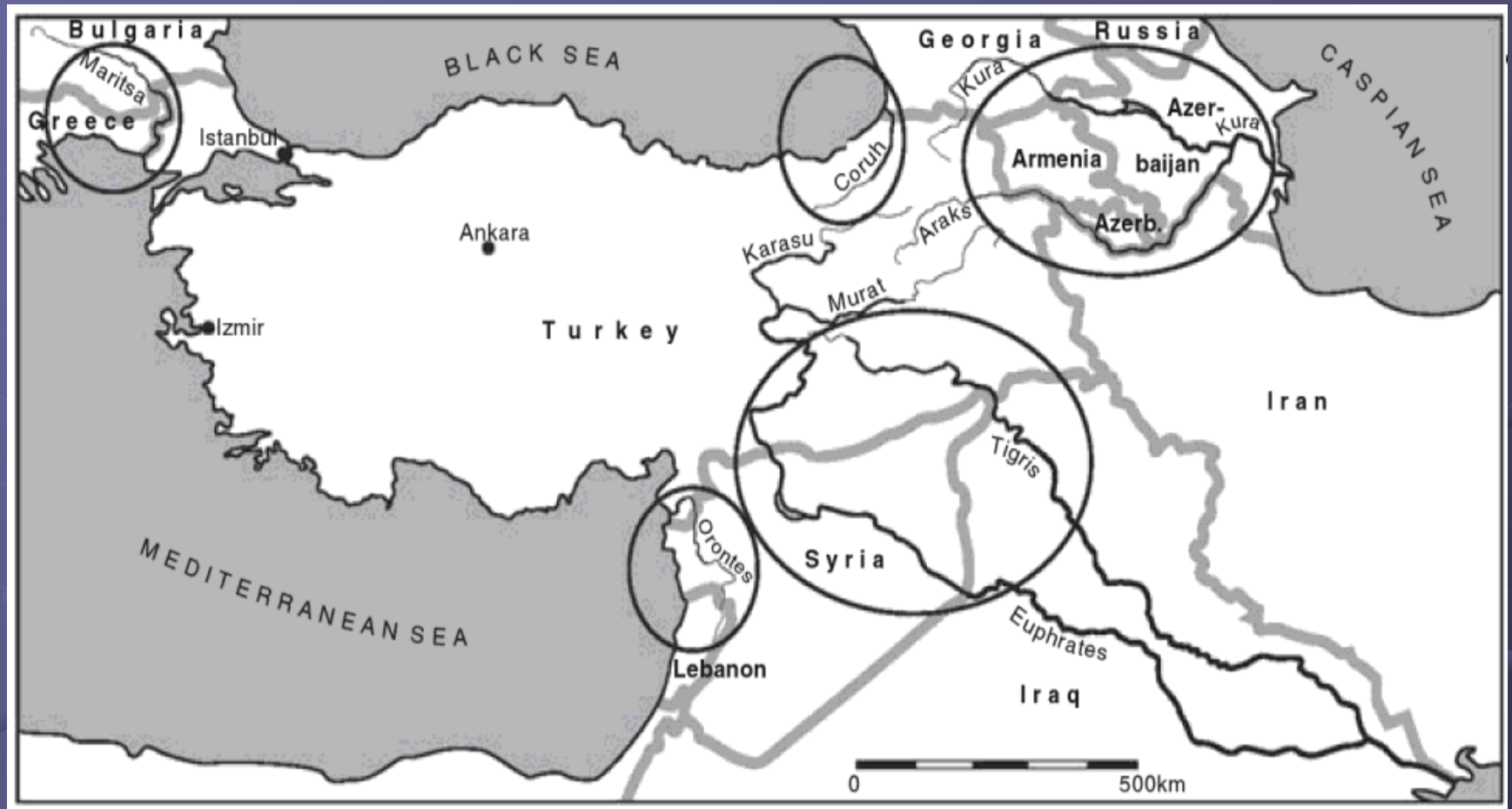
Water management structure in Bulgariariver

The country is divided in 4 basin districts





Turkey's transboundary rivers

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Aoos