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MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

WATER MANAGEMENT SCHOOL

1° International Training Course

URBAN WATER RESOURCES MANAGEMENT for AFRICA

Rome, Link Campus University

22 January–3February 2018

SUSTAINABLE DEVELOPMENT and WATER RESOURCES MANAGEMENT

Giorgio Pineschi

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QUANTITY’:

TOO MUCH WATER

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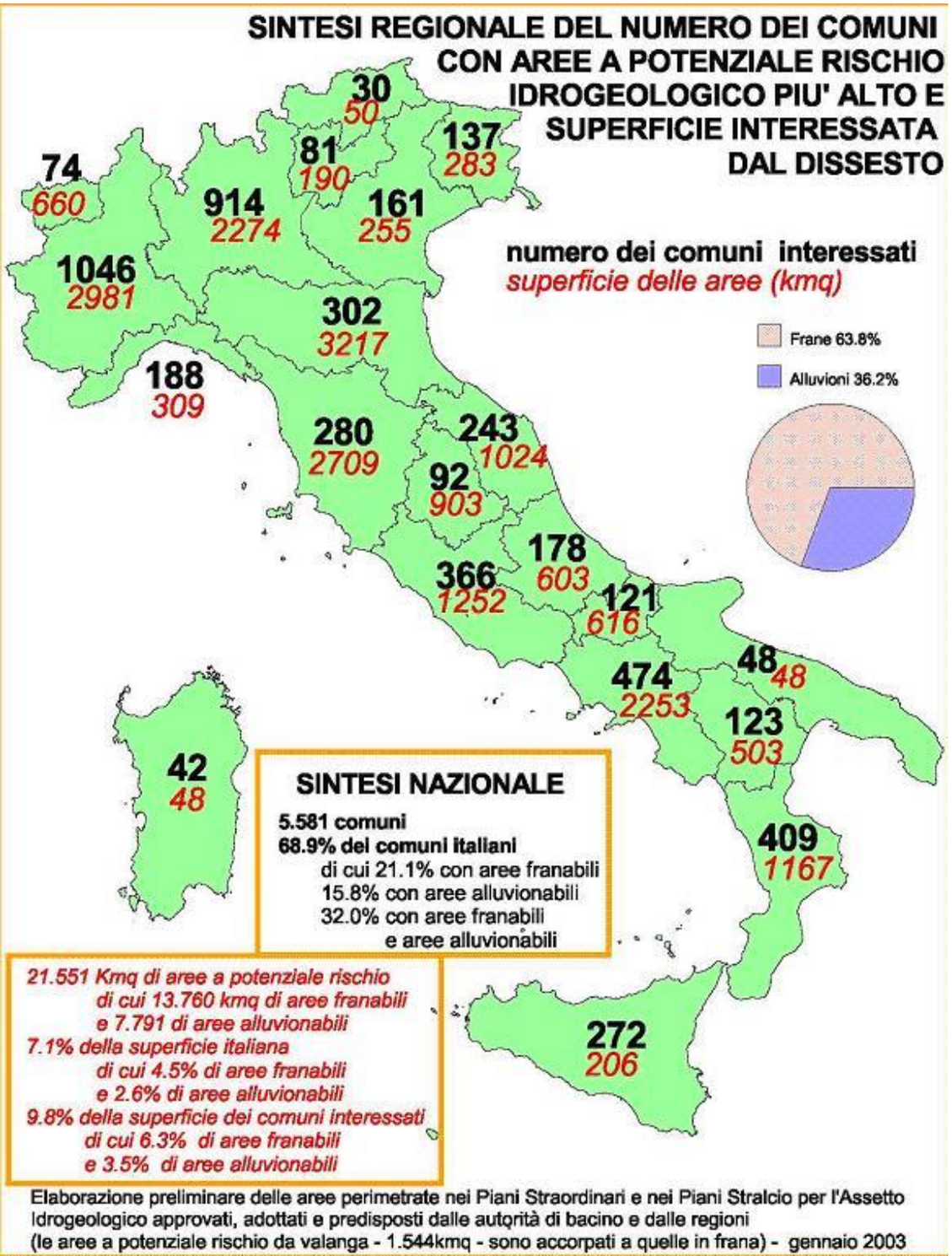
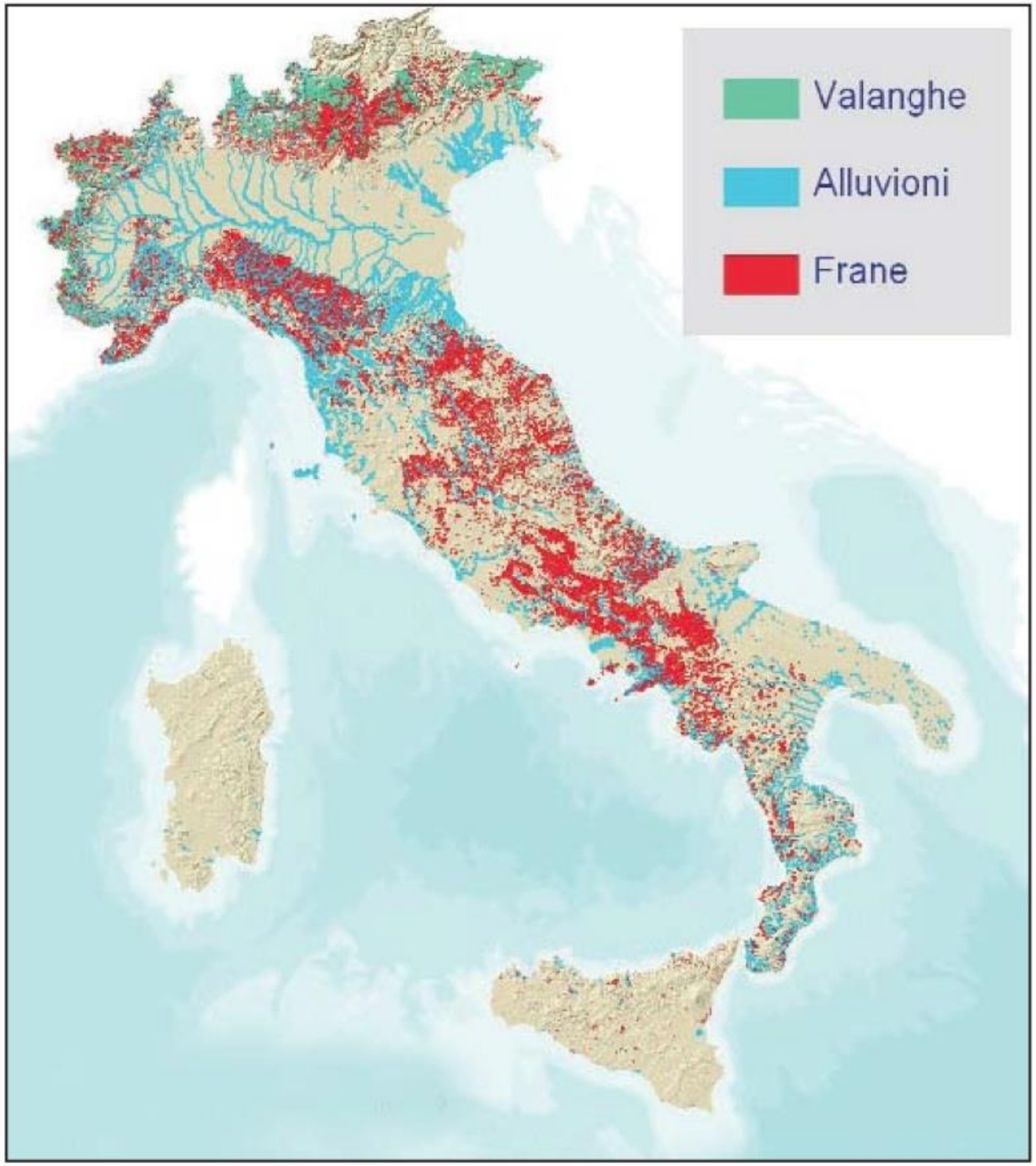
MAPPING AREAS UNDER RISK

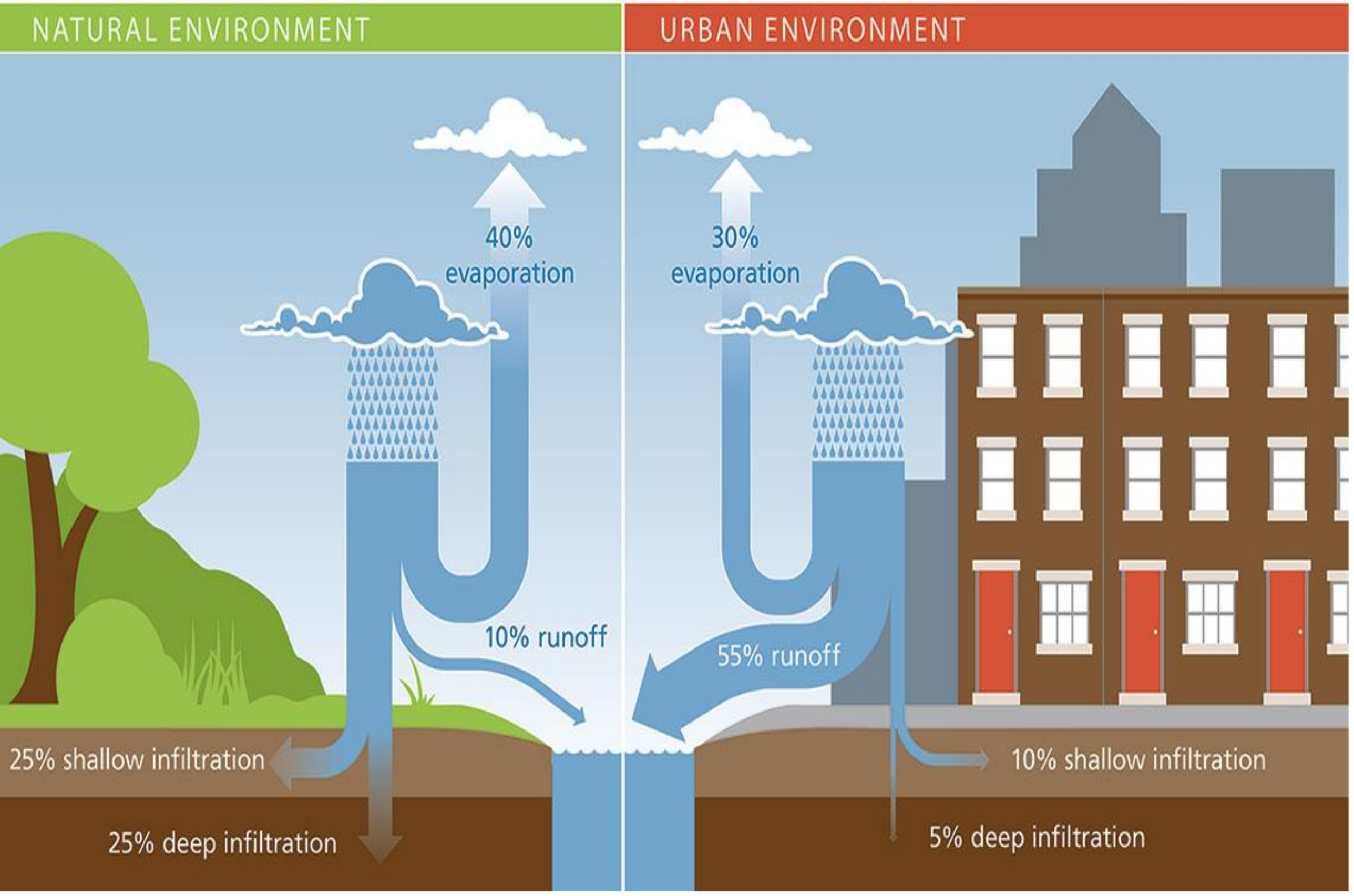




DISASTER RISK

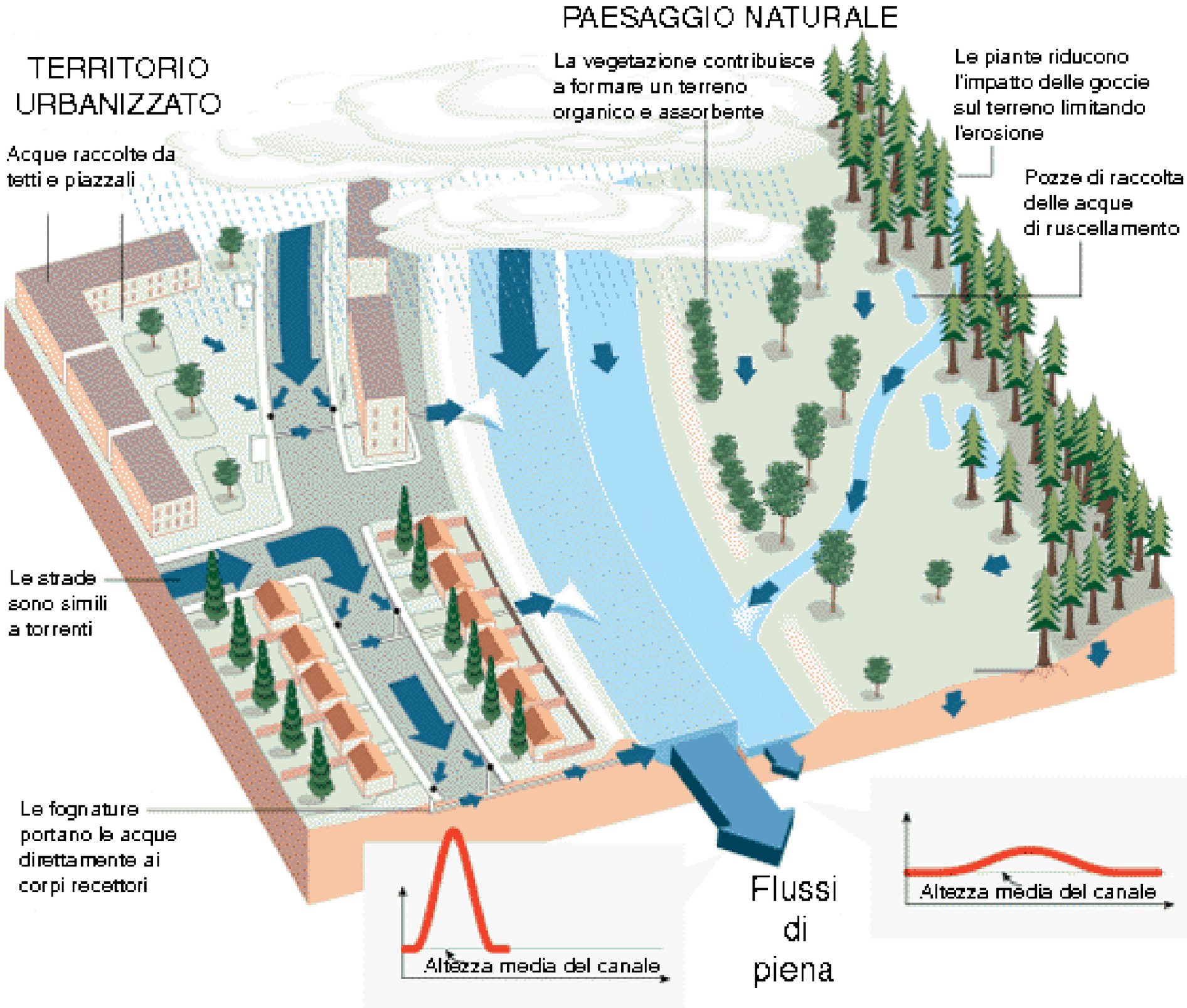
- **HAZARD**
  - Probability
    Severity
- **EXPOSURE**
  - Structures
    Population
    Economy
- **VULNERABILITY**
  - Physical
    Social
    Economic
    Environmental
- **CAPACITY AND MEASURES**
  - Physical planning
    Social capacity
    Economic capacity
    Management

The **risk equation**: calculating the **risk of harm**


NATURAL ENVIRONMENT
URBAN ENVIRONMENT
40%
evaporation
30%
evaporation
10% runoff
55% runoff
25% shallow infiltration
10% shallow infiltration
25% deep infiltration
5% deep infiltration

Più acqua più velocemente

L'urbanizzazione modifica l'apporto di acqua ai fiumi



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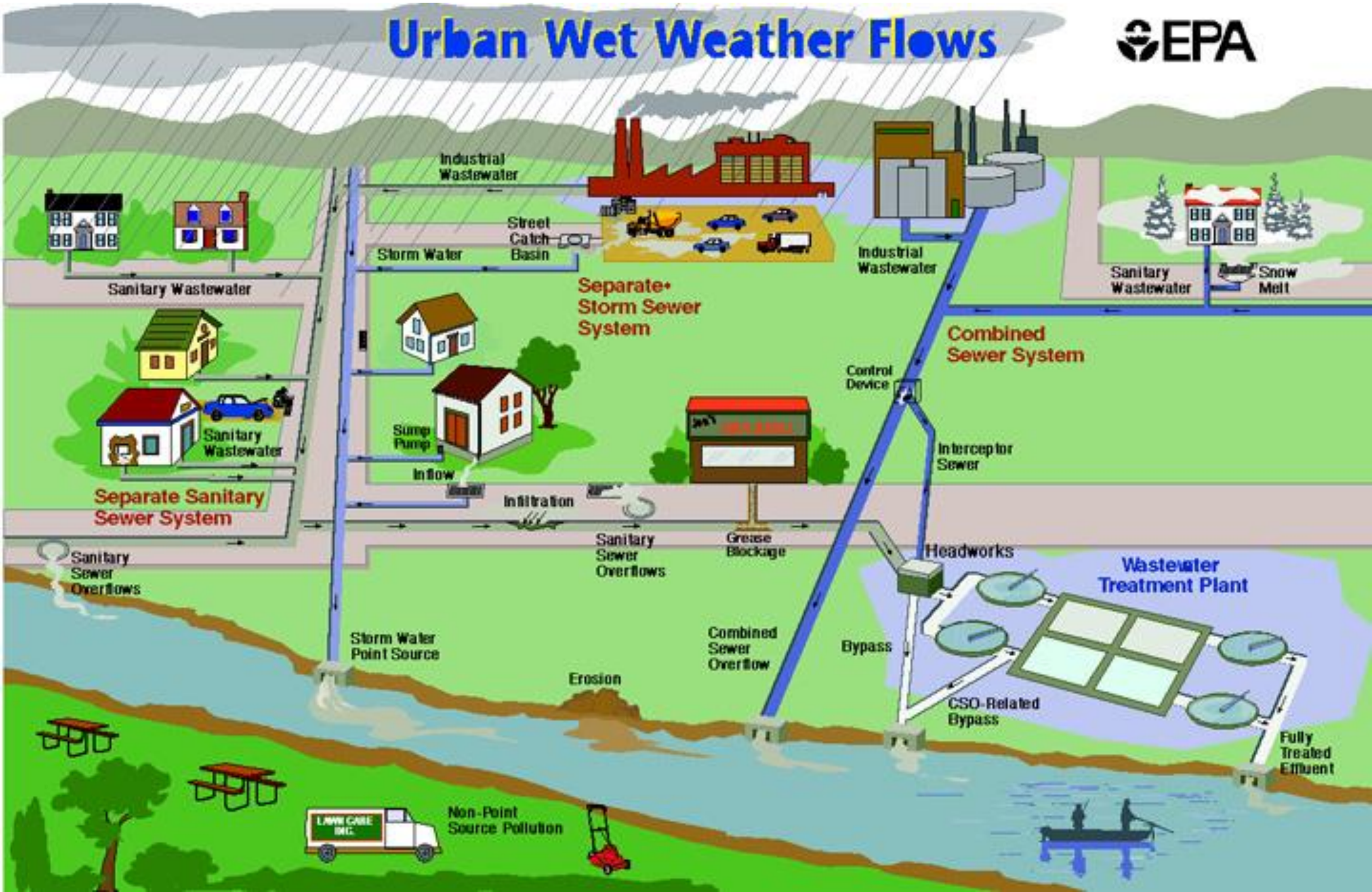
Urban Wet Weather Flows

EPA



First flush tank (MORE BLOCKS)

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SustainableDrainageSystems (SuDS).

The idea behindSuDSistotryto replicate naturalsystemsthatusecosteffectivesolutionswith low environmental impact todrainawaydirty and surface water run-offthroughcollection, storage, and cleaningbeforeallowingittobereleasedslowly back into the environment, suchasinto water courses.

Natural Water Retention Measures (NWRM)

Natural Water RetentionMeasures are multi-functionalmeasuresthataimtoprotect water resources and addresswater-relatedchallengesbyrestoring or maintainingecosystemsaswellasnaturalfeatures and characteristicsof water bodiesusingnaturalmeans and processes. […]

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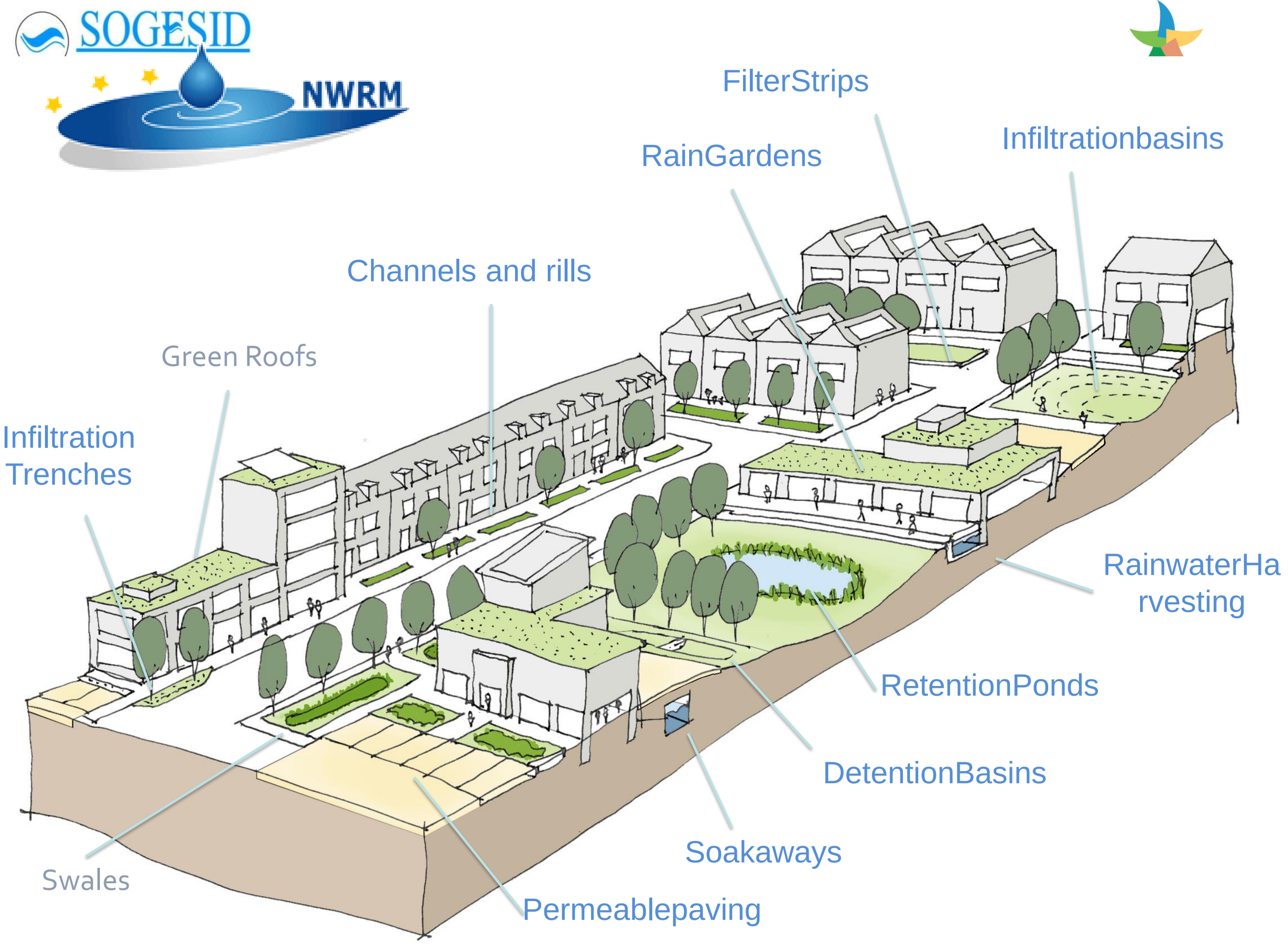
NWRM



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QUANTITY’:

TOO SCARCE

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DROUGHT

Natural and temporary situation of drastic reduction of water availability

ARIDITY

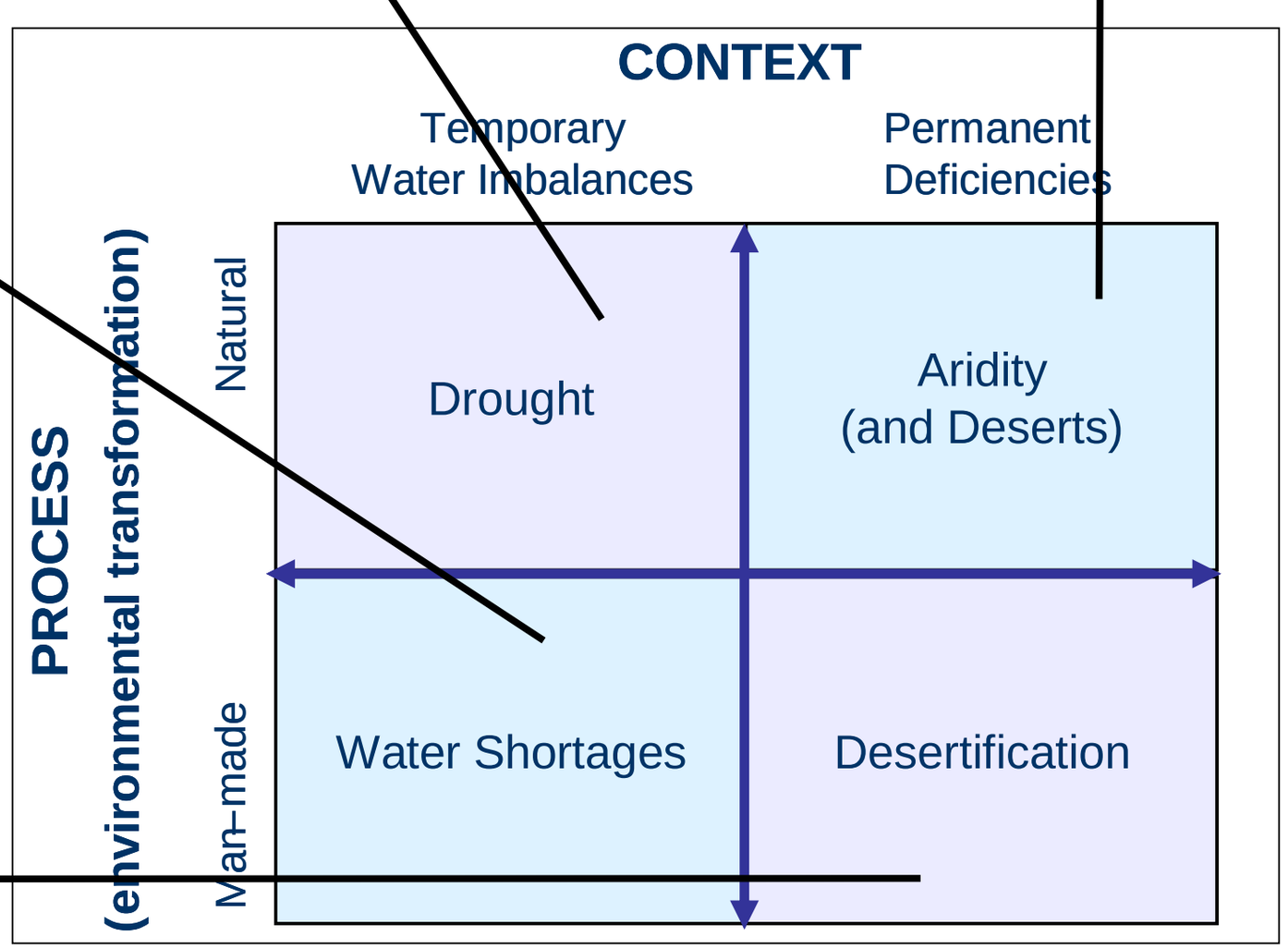
Natural and permanent condition resulting from a lack of precipitation

WATER SCARCITY

Imbalance between availability and demand

DESERTIFICATION

Degradation of soil in arid and semi-arid areas due to several drivers, including climate changes and human activities



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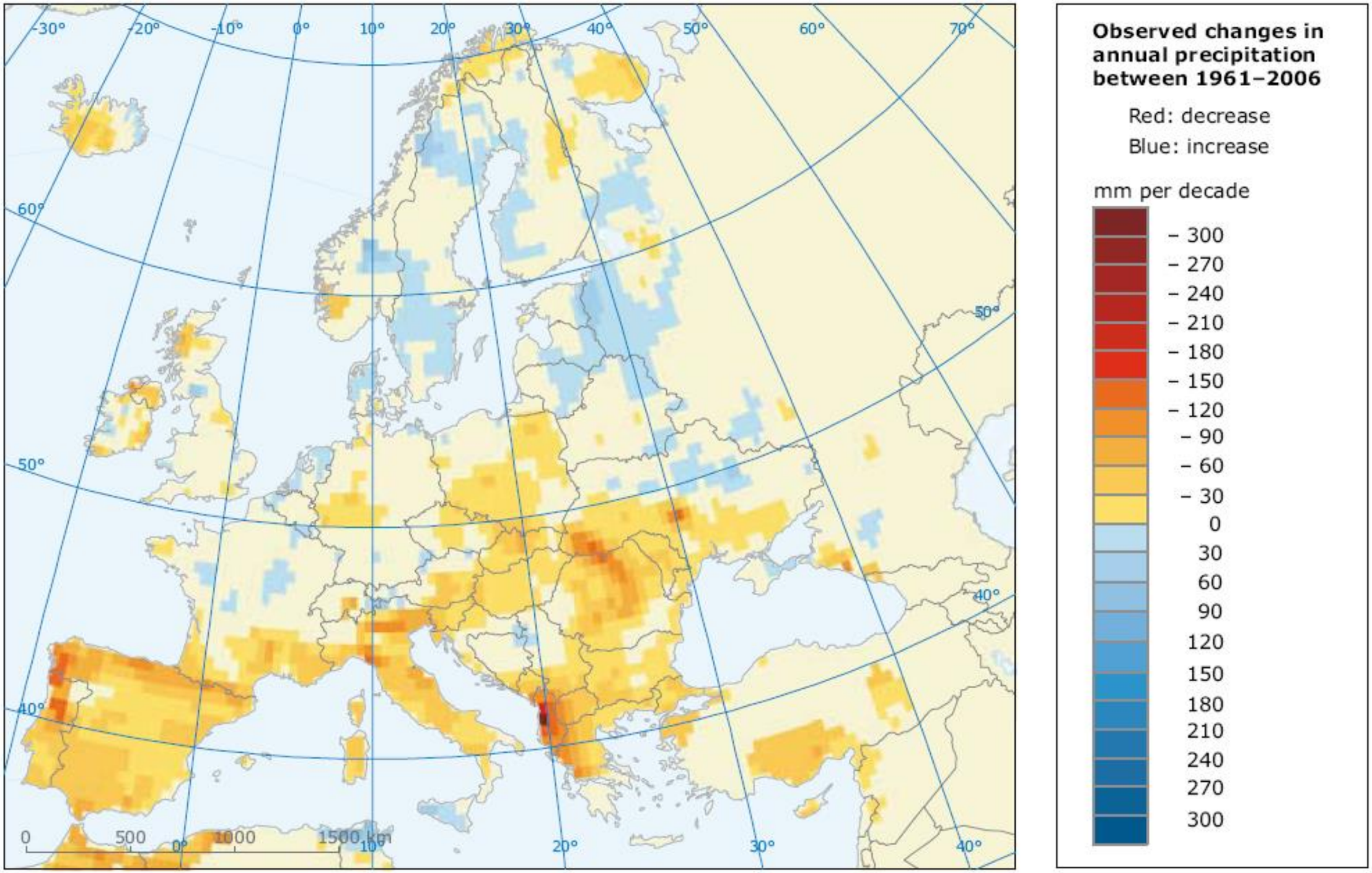
Climate change: the past



Source: EU Commission

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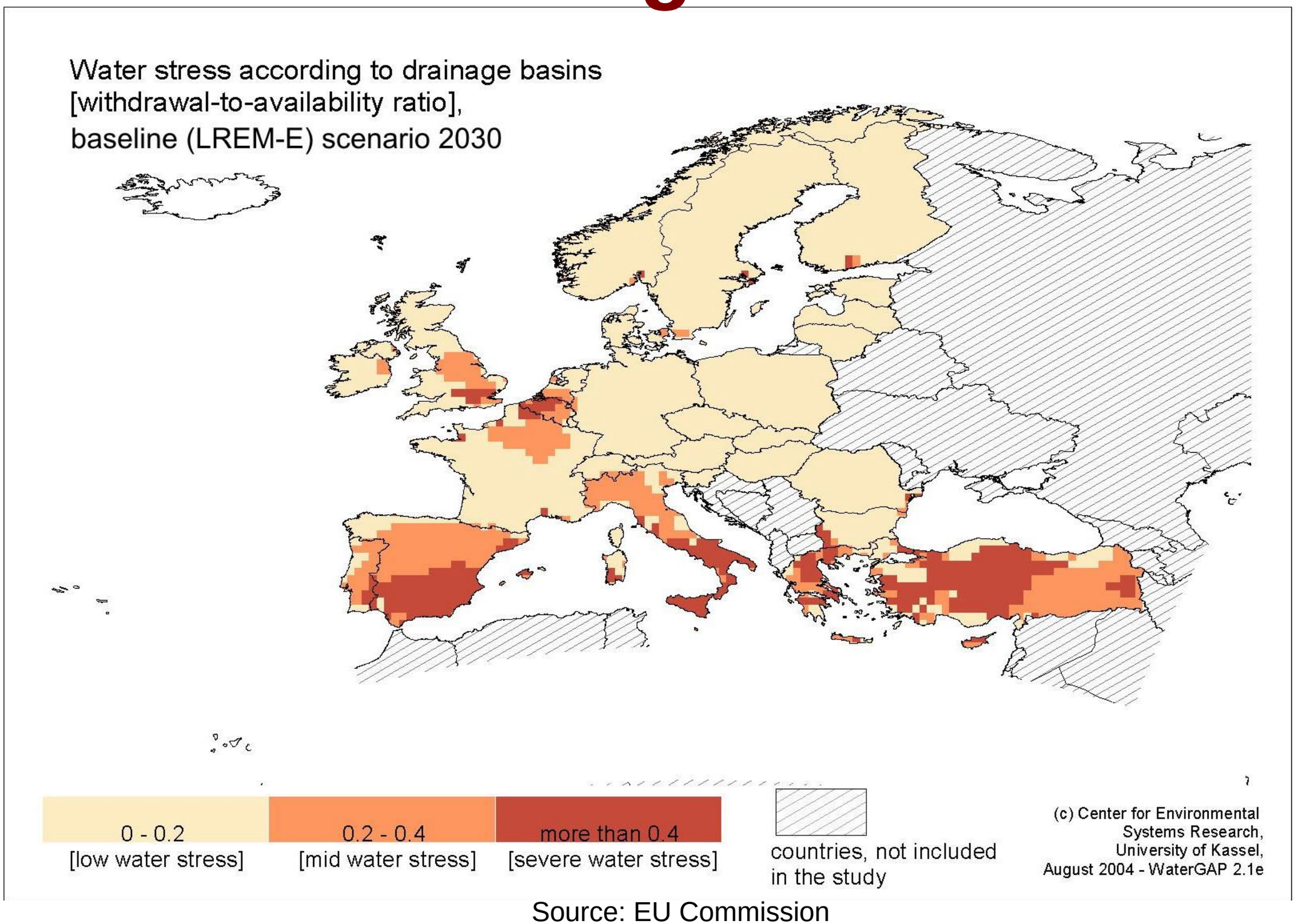
Climate change: the future



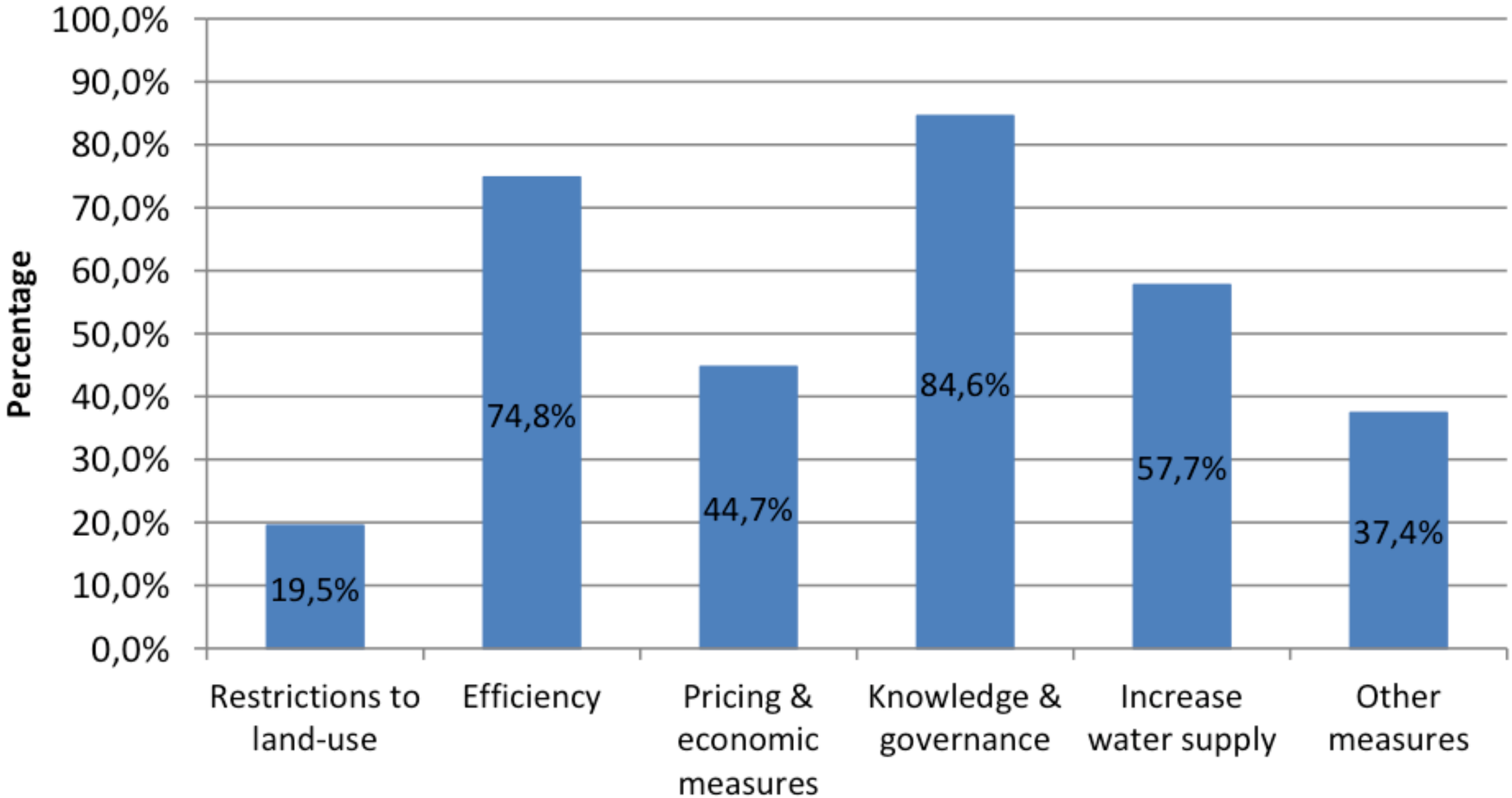
Source: EU Commission

Fig. 2. Occurrence of Drought[5]

Fig. 3. Occurrence of Water Scarcity[5]

Source: Reviewof the EU policy on WS&DDocument

Water scarcity and droughts - Measures (% of RBMPs)



Source: Reviewof the EU policy on WS&DDocument

Water Scarcity indicators

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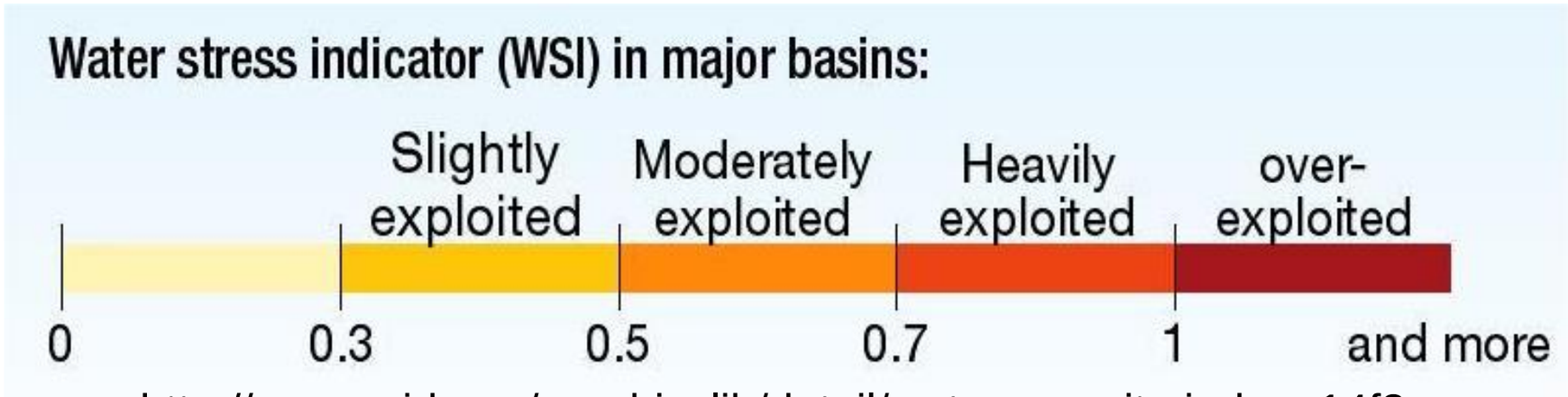
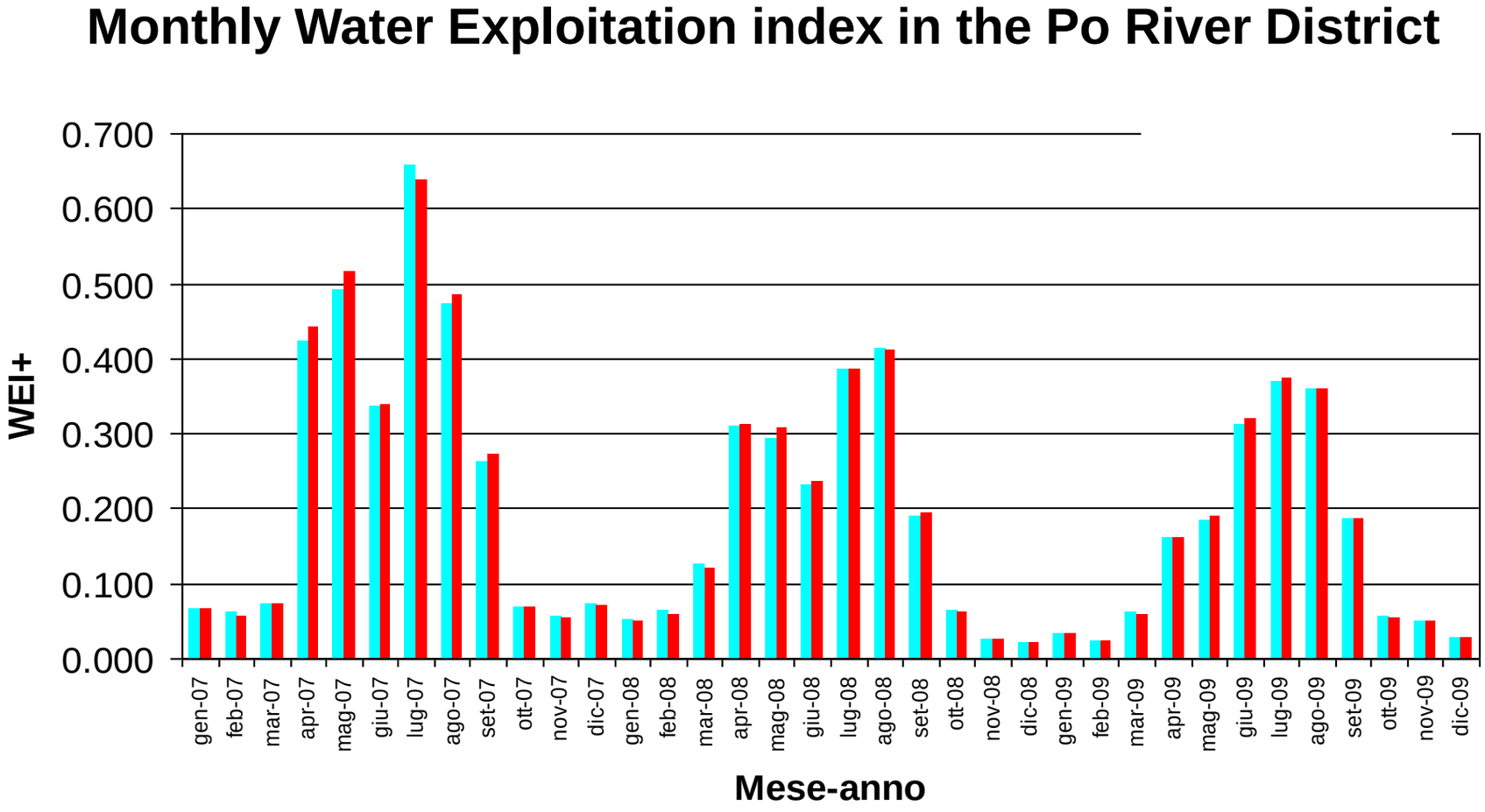


Source: http://www.grida.no/graphicslib/detail/water-scarcity-index_14f3



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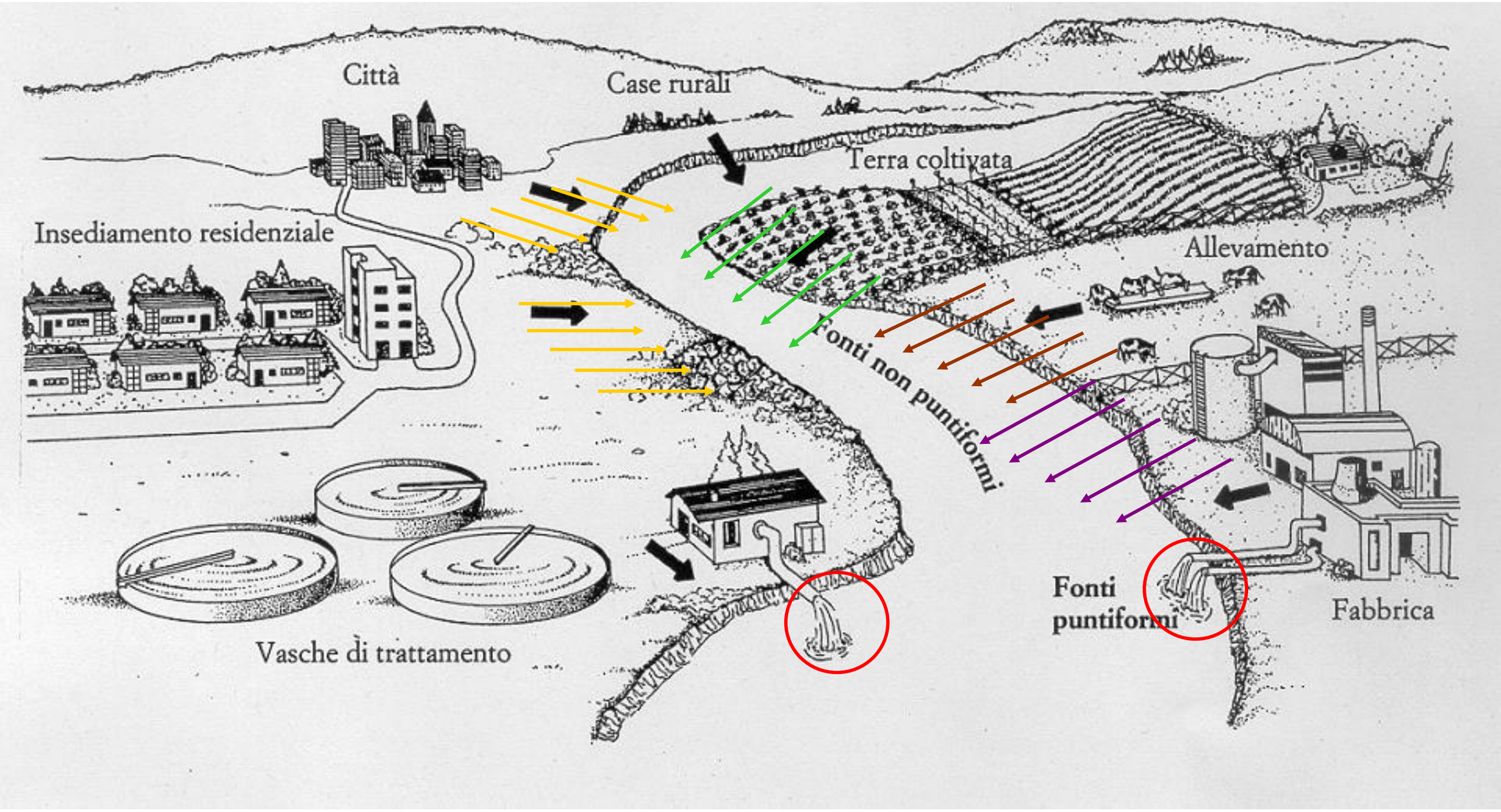
QUALITY:
POLLUTION


Città
Case rurali
Terra coltivata
Insediamento residenziale
Allevamento
Fonti non puntiformi
Fonti puntiformi
Fabbrica
Vasche di trattamento

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WATER POLLUTION DRIVERS

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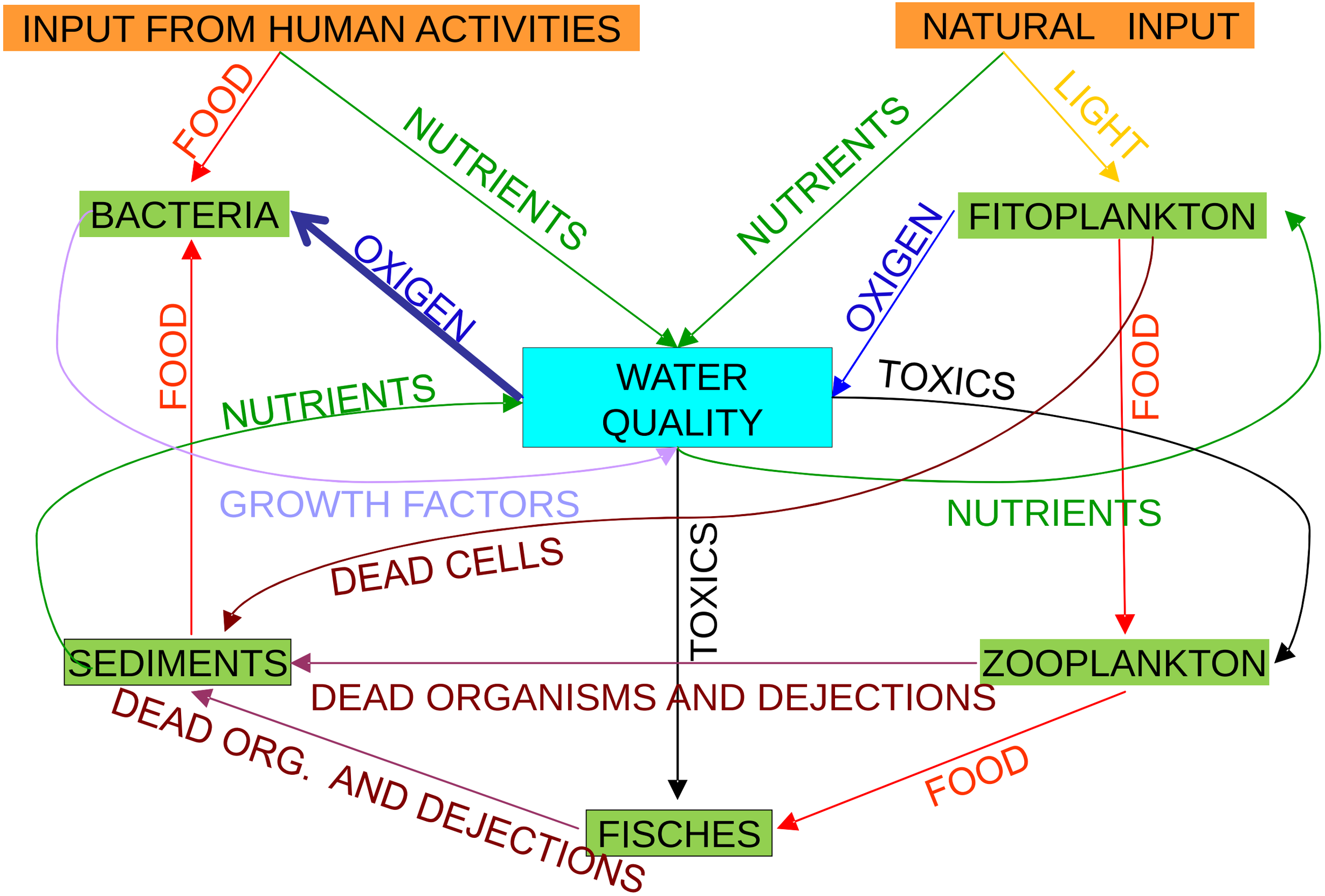

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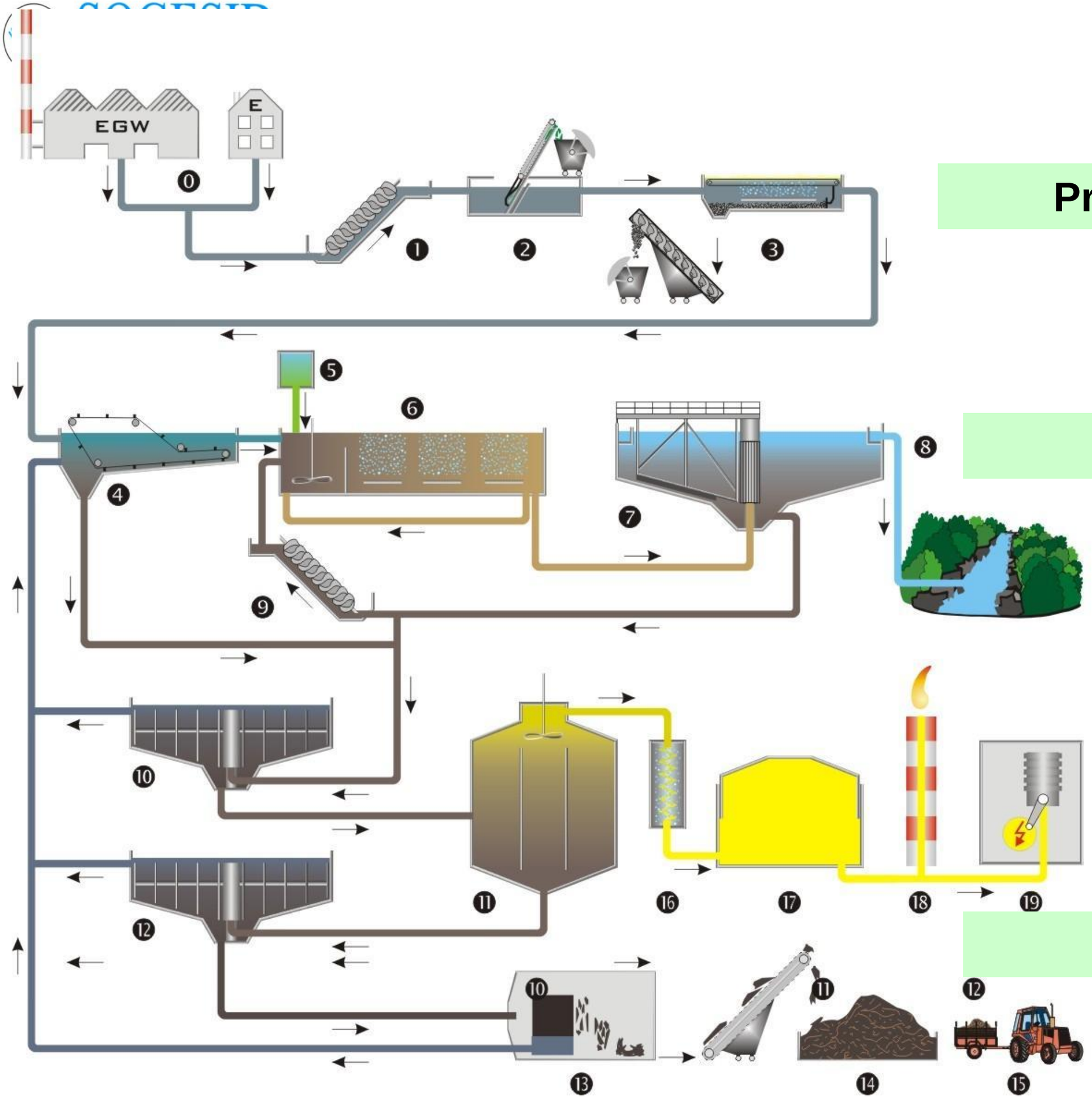
Pre-treatment

Water Line

Sludge Line



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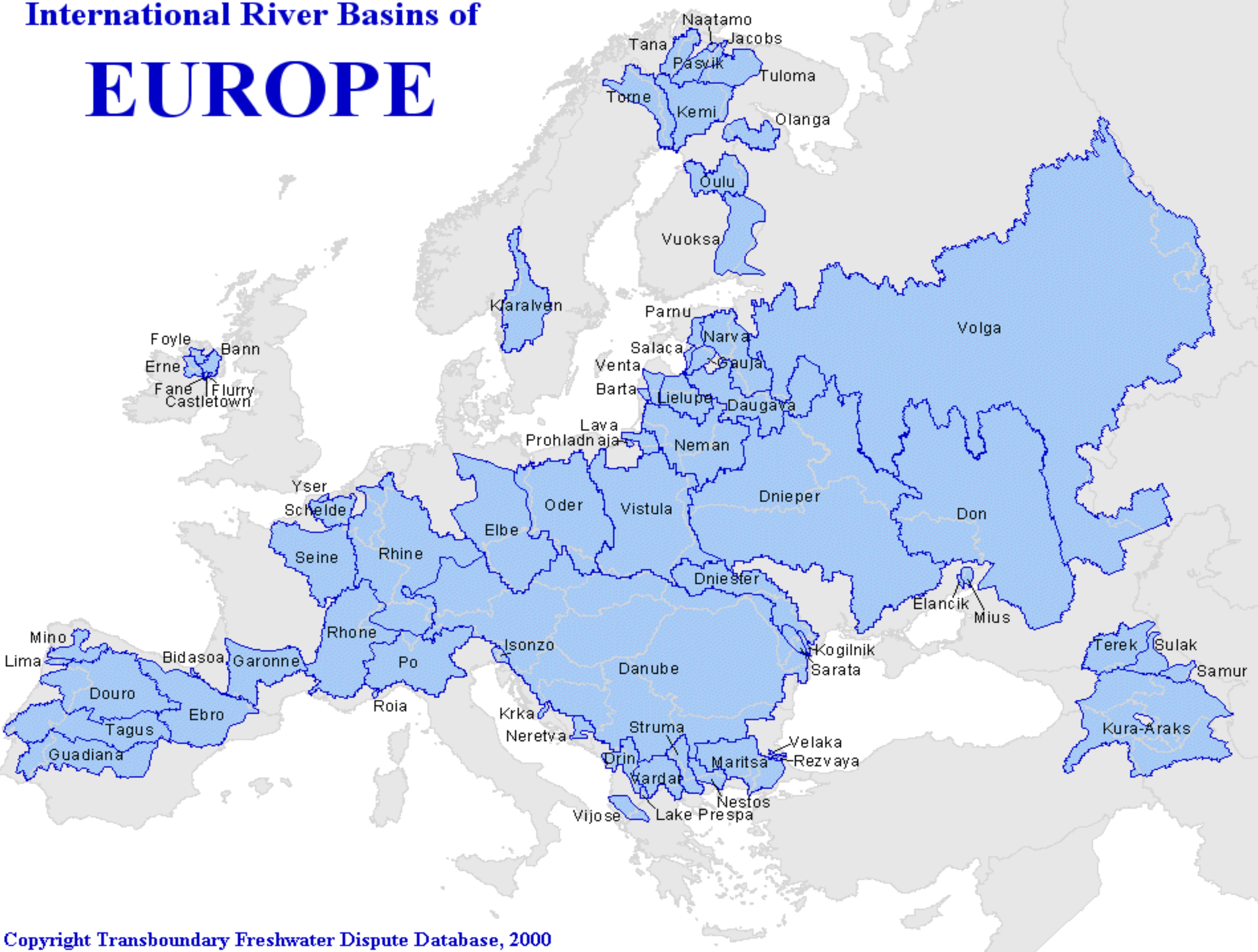
WFD FD

Water Framework Directive Flood Directive

Both Directives address for an integrated approach to river basin management, through a collaborative governance agenda able to conjugate multi-objectives, multi-levels and multi-stakeholders decision making processes and to achieve jointly the objectives of environmental enhancement and flood risk

International River Basins of

EUROPE



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European River basins

Freshwater network

Water bodies

River Basins

RB Districts

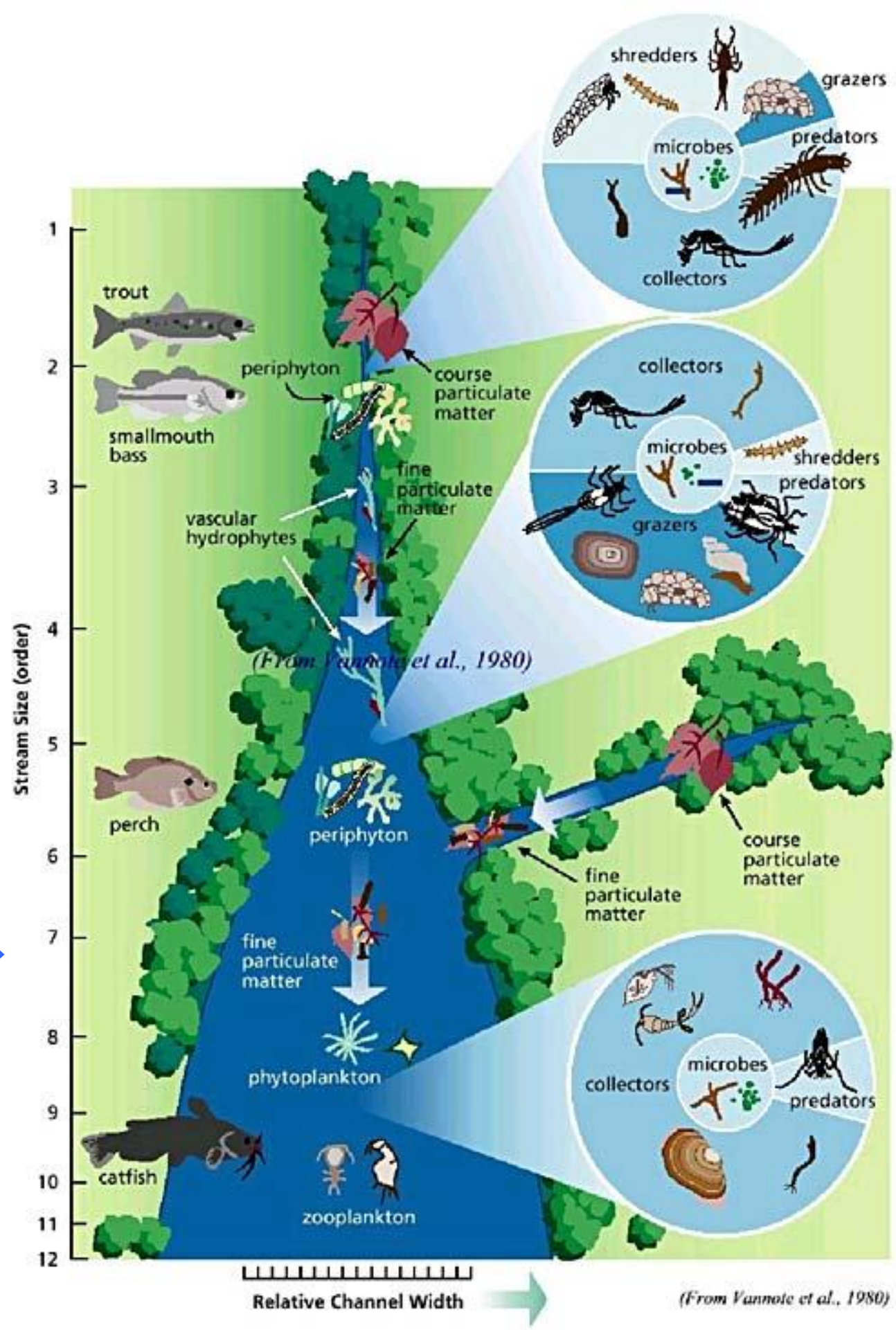
Ecological Status

WFD

***2015*: Good Status for all Water Bodies**

Implementation of measures for water quality protection and remediation

QUALITY



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Hydro-Morph. conditions

FD

2015: RBMPs

Mapsof the hazard and risrkareas;

FLOODS mitigation and prevention measures

SAFE Conditions

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Ecological Status

Conflicts

Hydro-Morph. conditions

WFD

2015: Good Status for all Water Bodies

Implementation of measures for water quality protection and remediation

COORDINATION

FD

2015: RBMPs

Mapsof the hazard and risrkareas;

FLOODS mitigation and prevention measures

QUALITY

SAFE Conditions

Need for new tools and new approaches

Blueprint: Turn colors in green

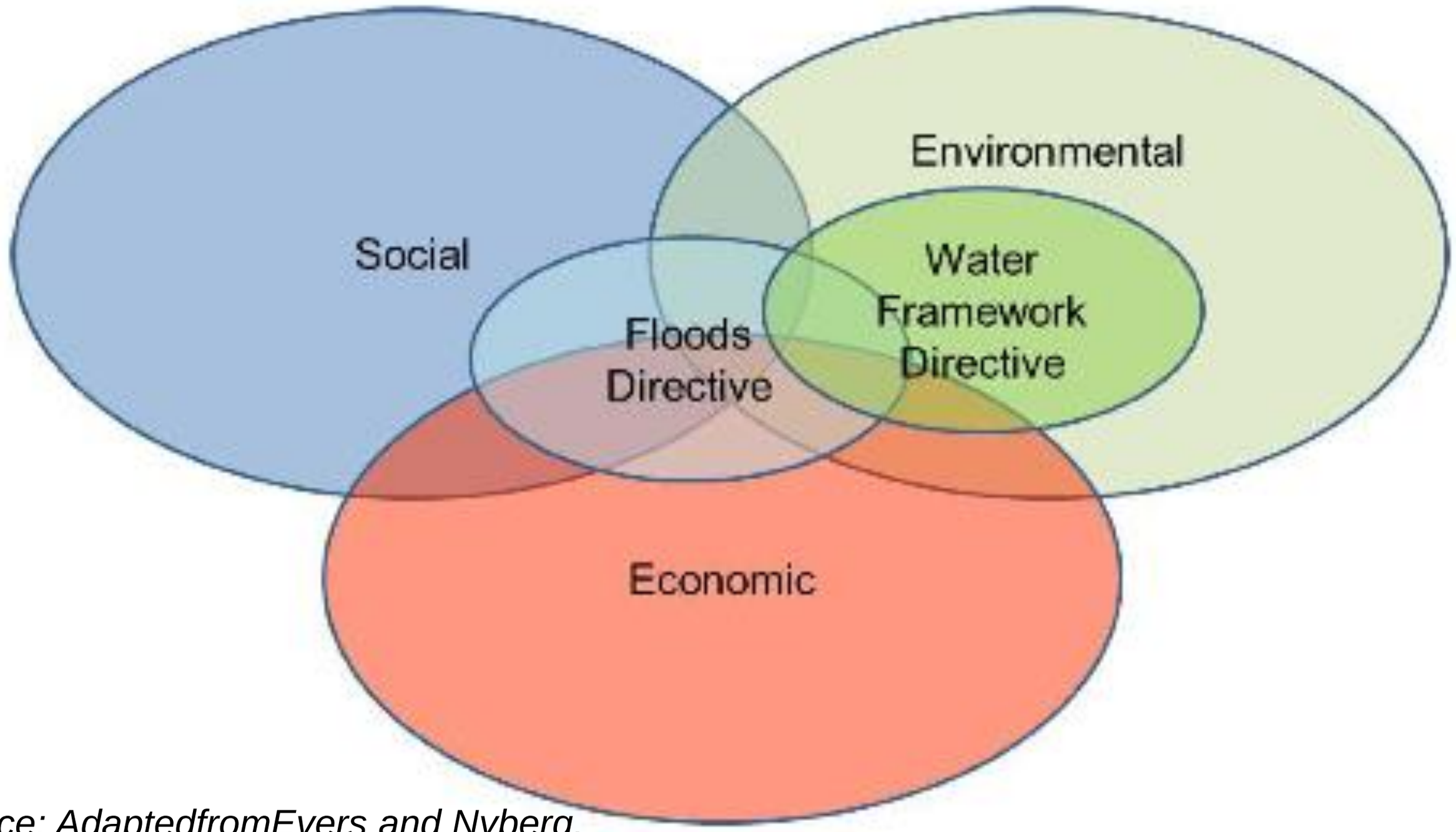
Flood protection and WS&S

GREY → GREEN

Agriculture and Integrated Water Management

BLUE → GREEN

Sustainability addressed by the FD and WFD and their overlapping areas



(Source: AdaptedfromEvers and Nyberg,

European approach to water quality protection refers to Water bodies

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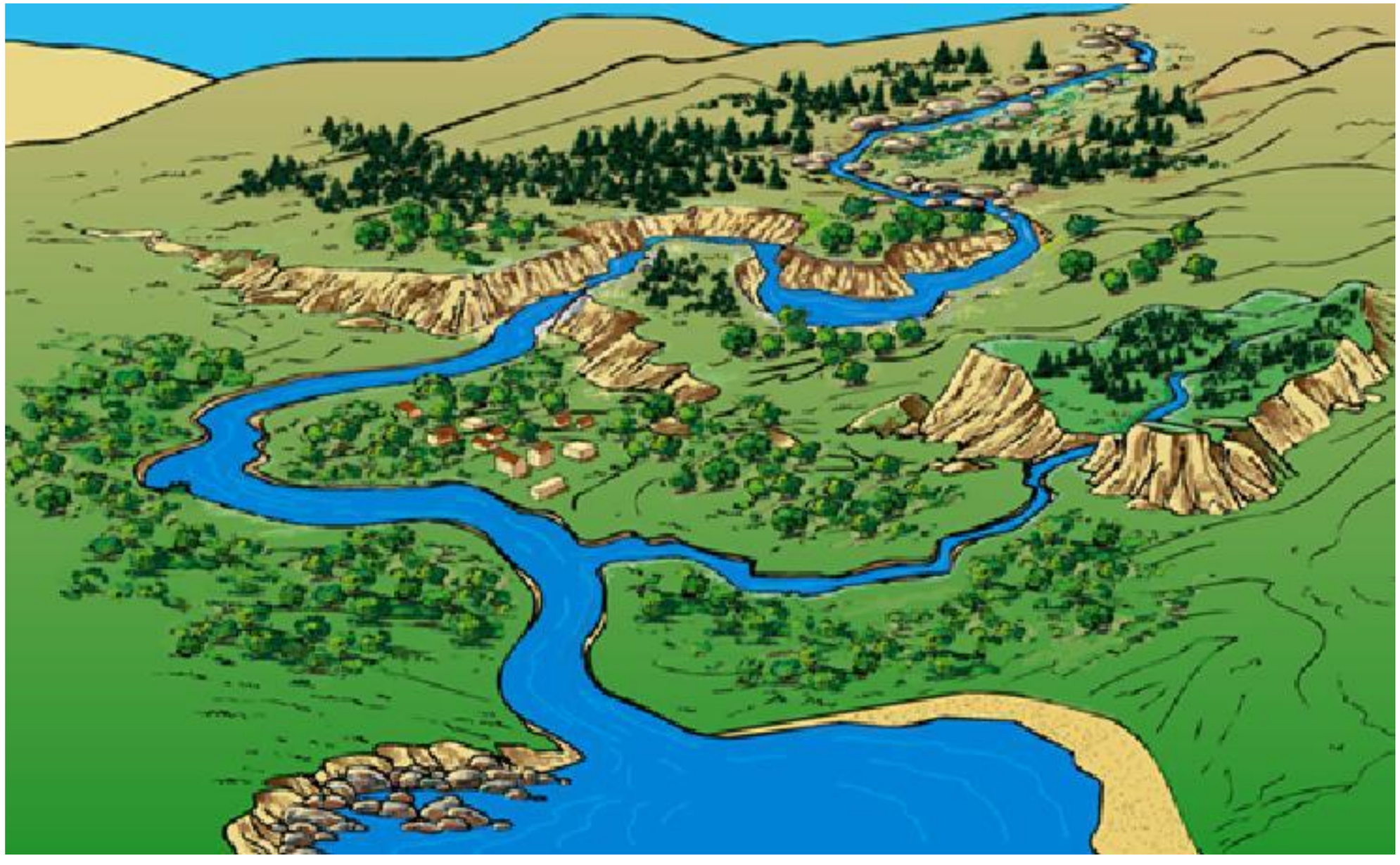
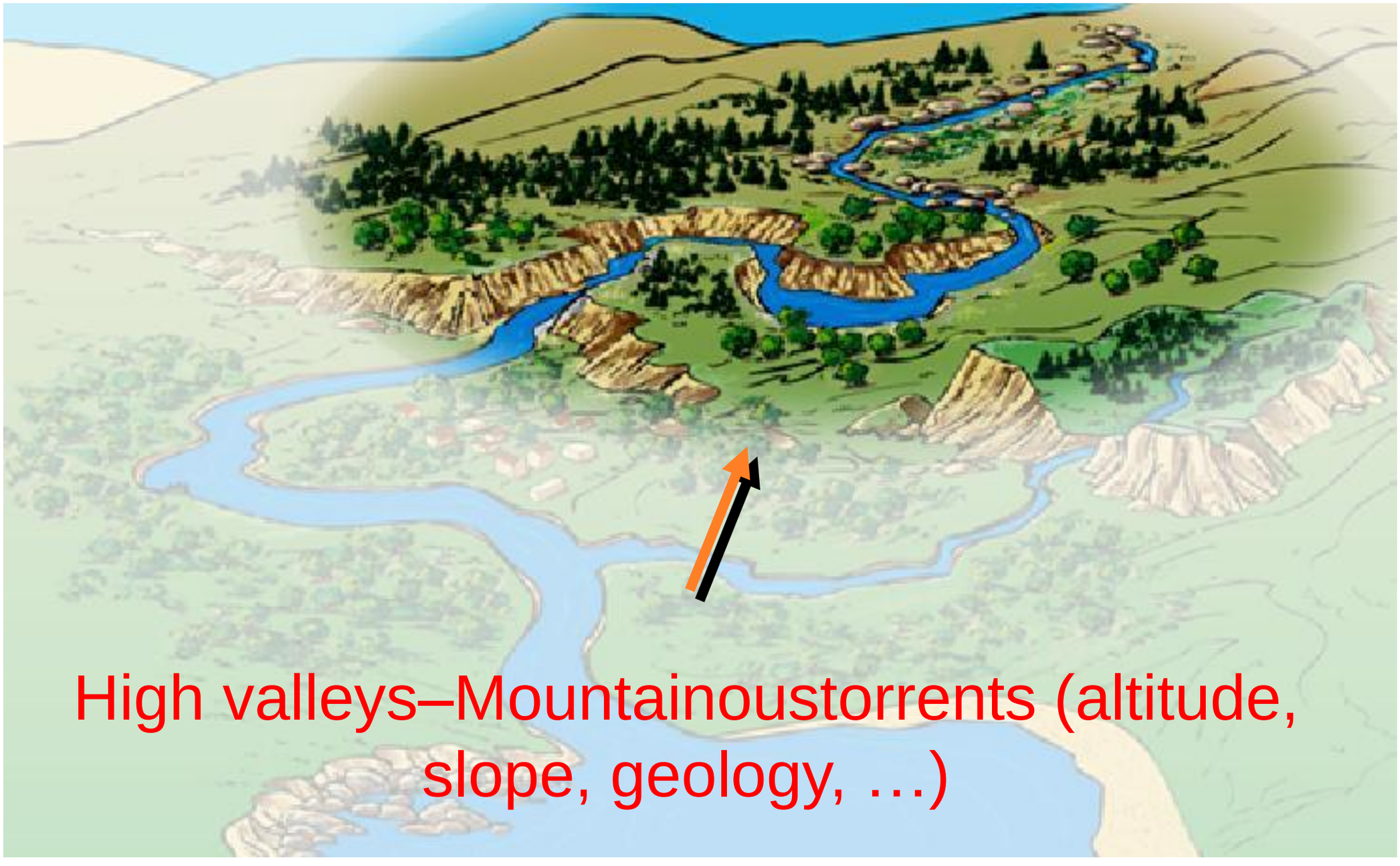
Identification of « types »

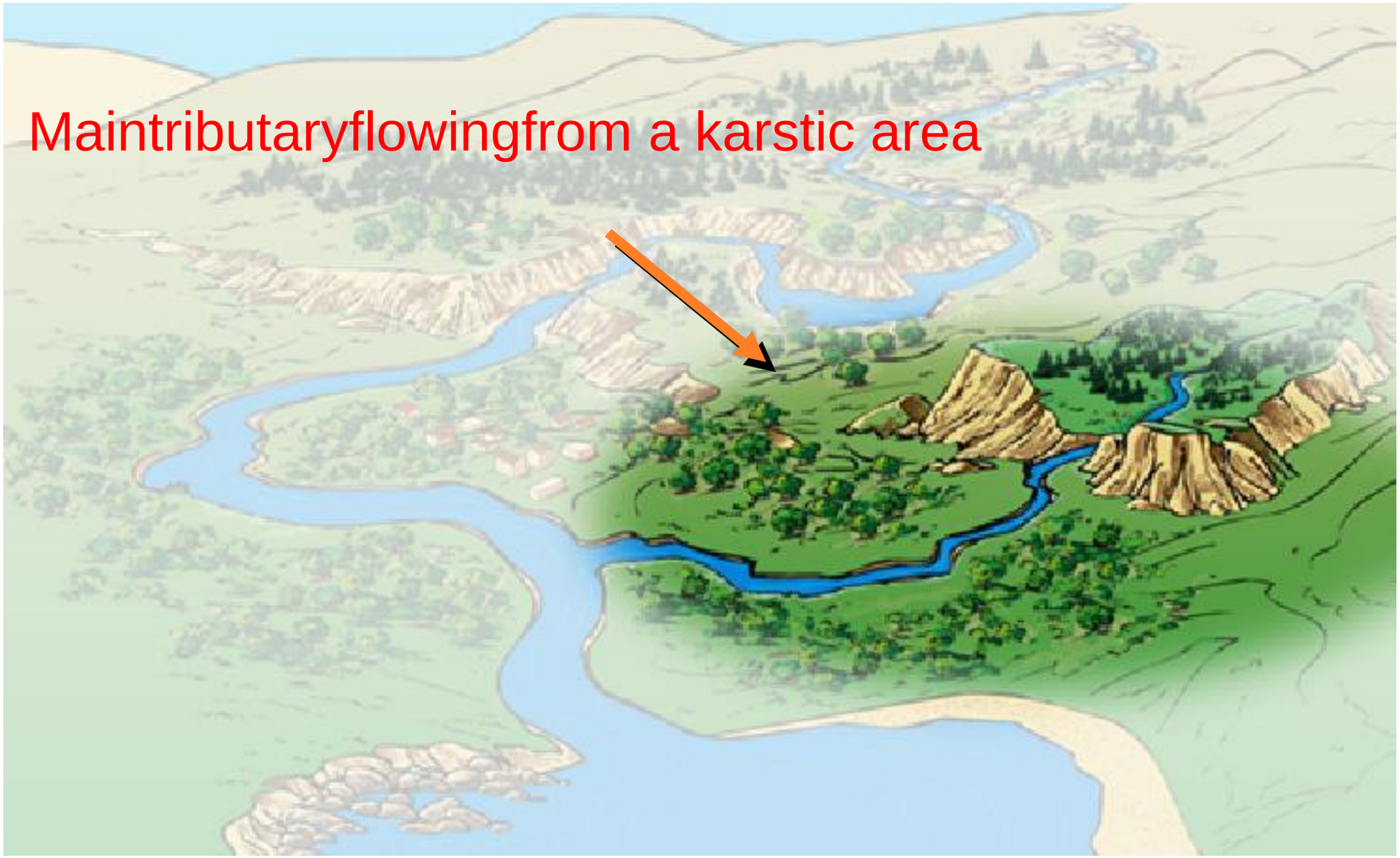


Identification of body type



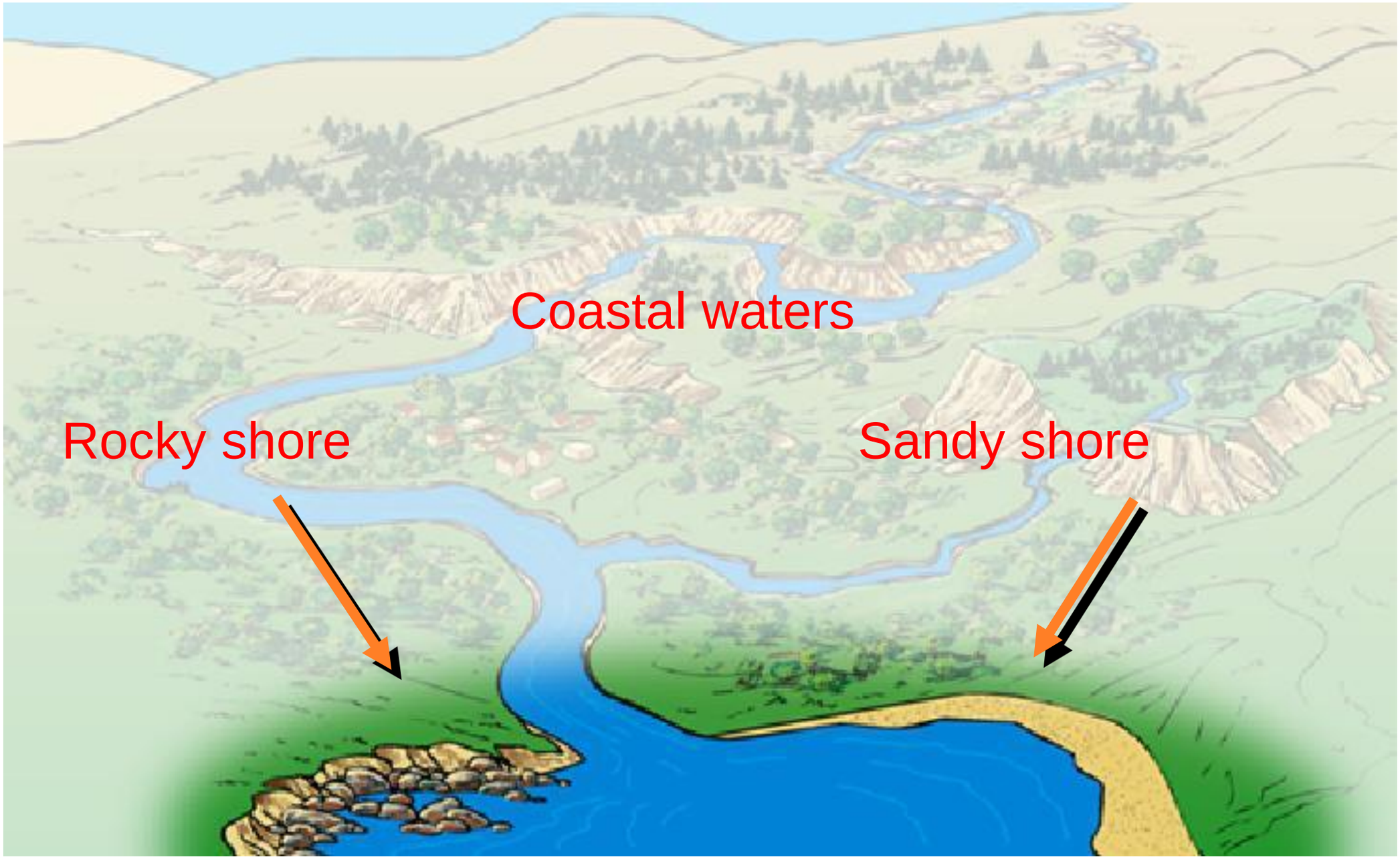
High valleys–Mountainoustorrents (altitude, slope, geology, …)

Identification of body type

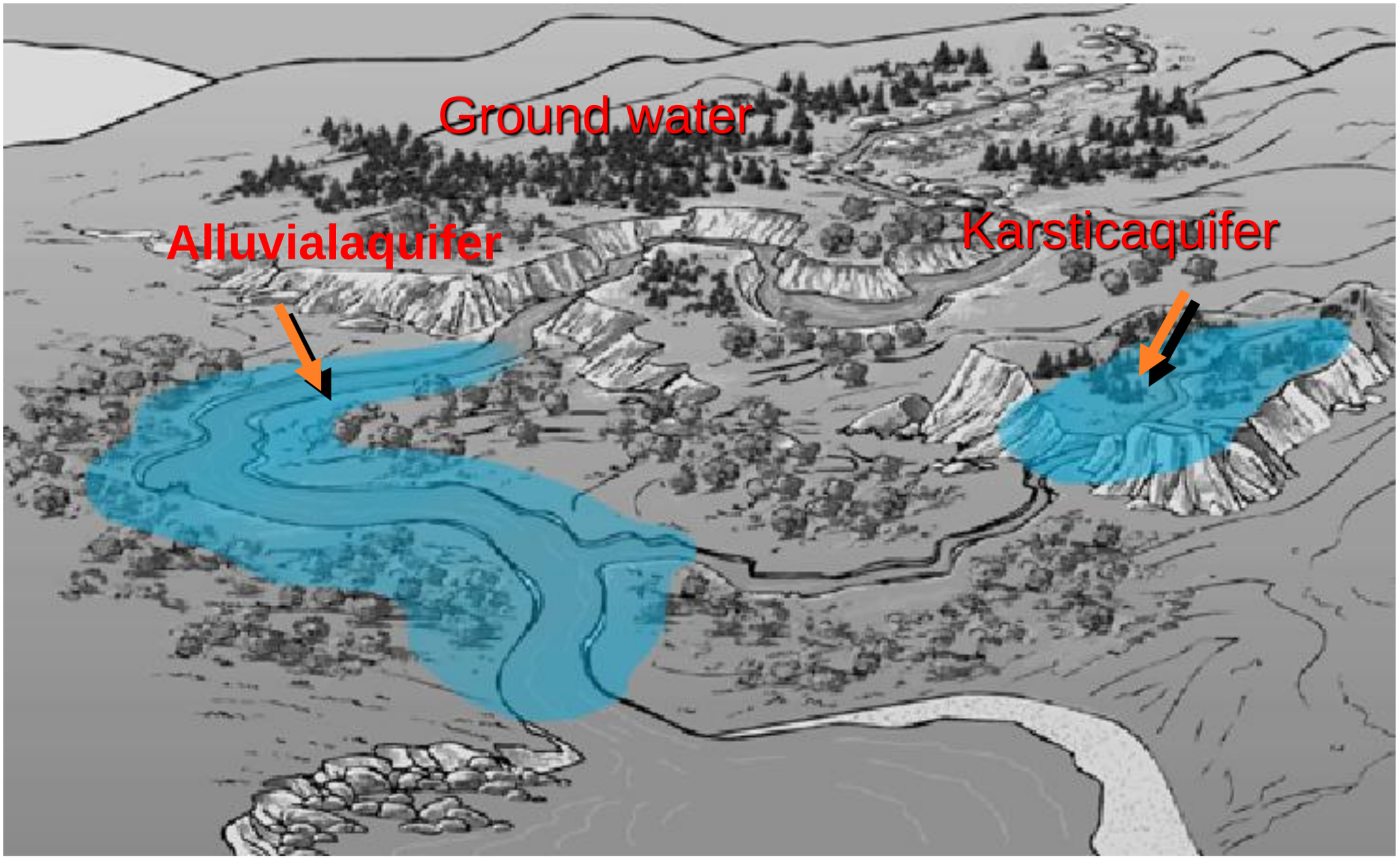


Identification of body type

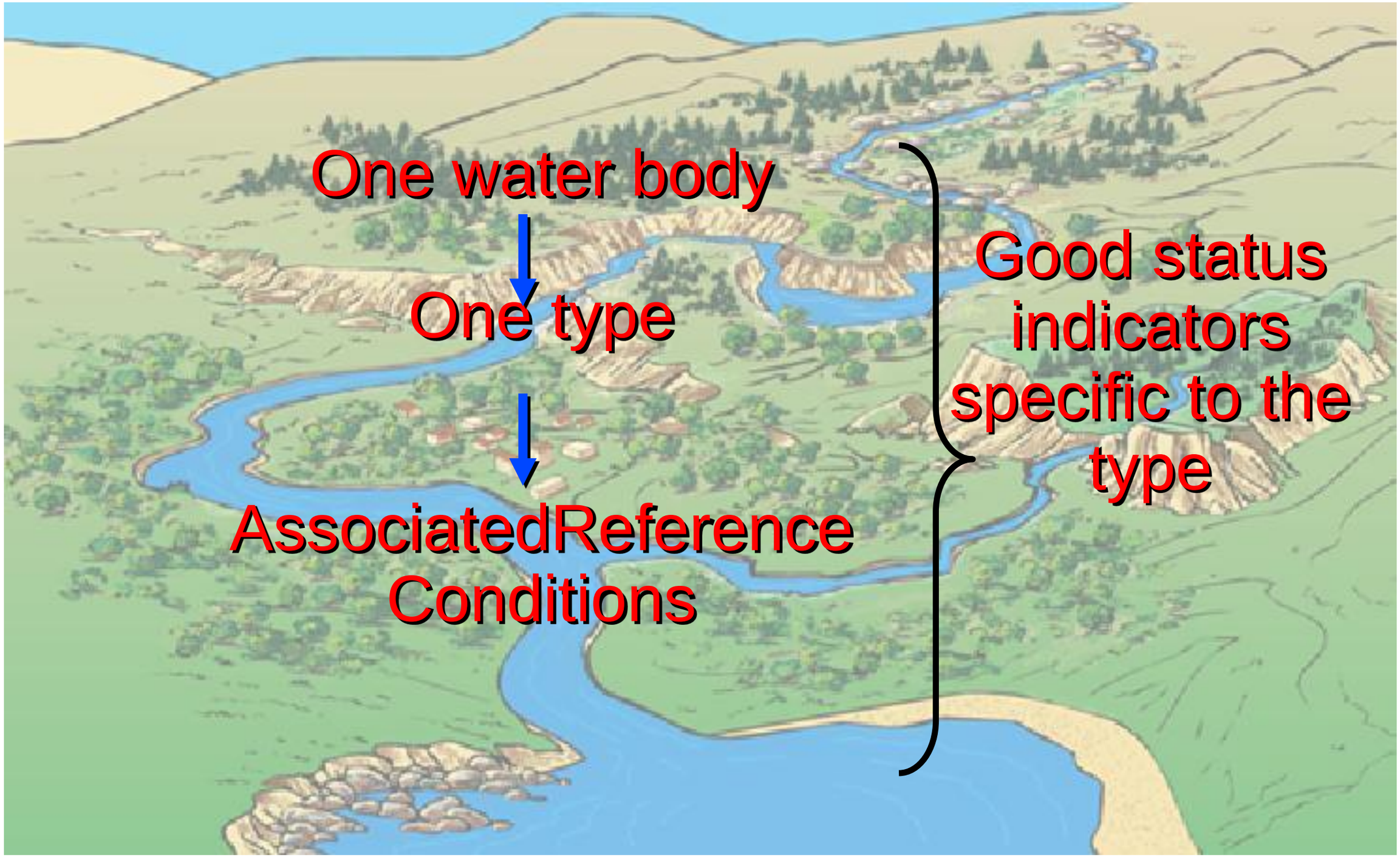
Identification of body type



Identification of body type



Classification



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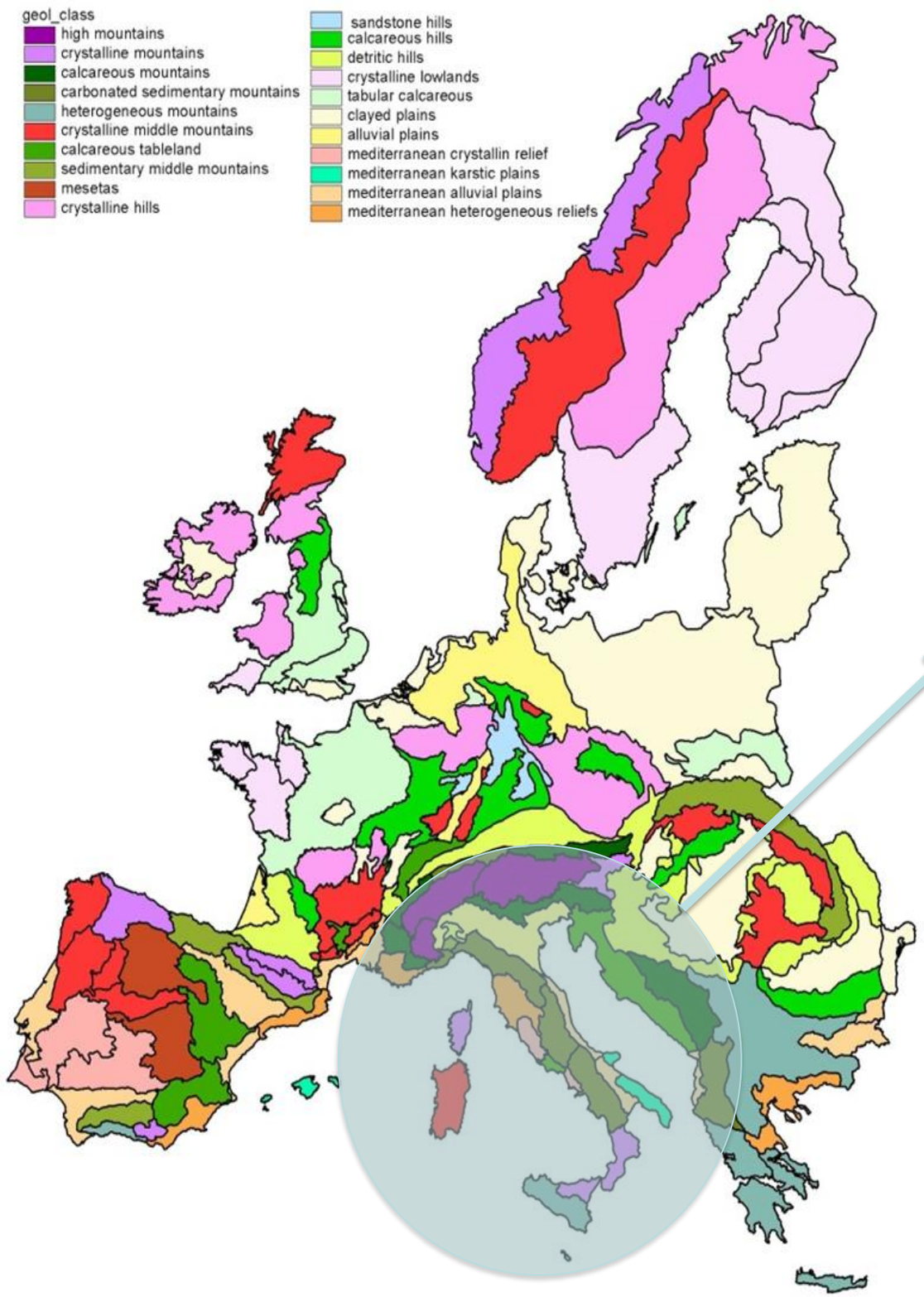

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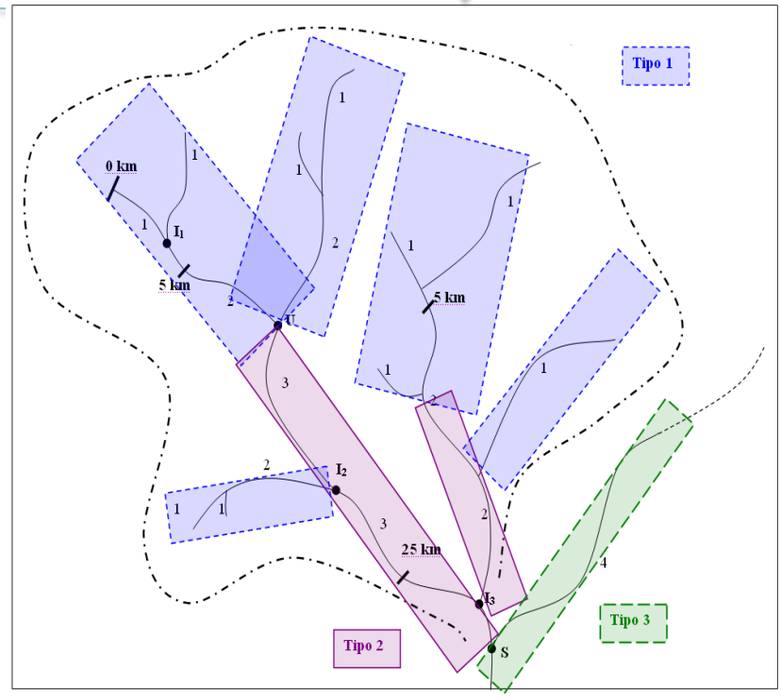
Regioni_ 95.shp



Water Types Identification

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Quality Status of Surface Water

Ecological Status

Classification

Quality Elements

Biological Elements

Idromorphological elements supporting biological elements

Chemical and phisico-chemical elements supporting biological elemets

ReferenceConditions

Chemical Status

Ecological Status

Ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems.

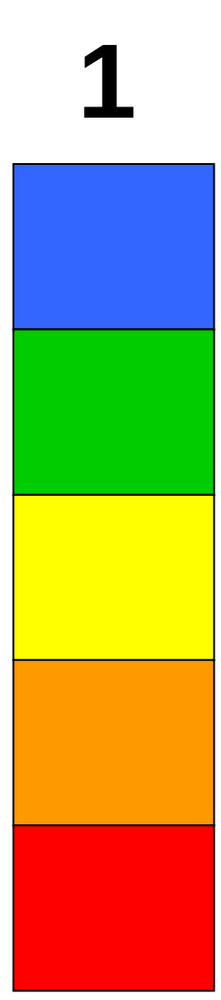
- **biological,**
- **hydromorphological**
- **physico-chemical**

Member States are required to achieve good surface water and groundwater status by 2015,which means the status achieved by a surface water body when both its ecological and its chemical status are at least good. For groundwater,chemical quality and quantitative status should be good.

Assessment of the ecological status

EQR = Observed value / Reference value

elements of biological quality



Environmental objective "surface waters"

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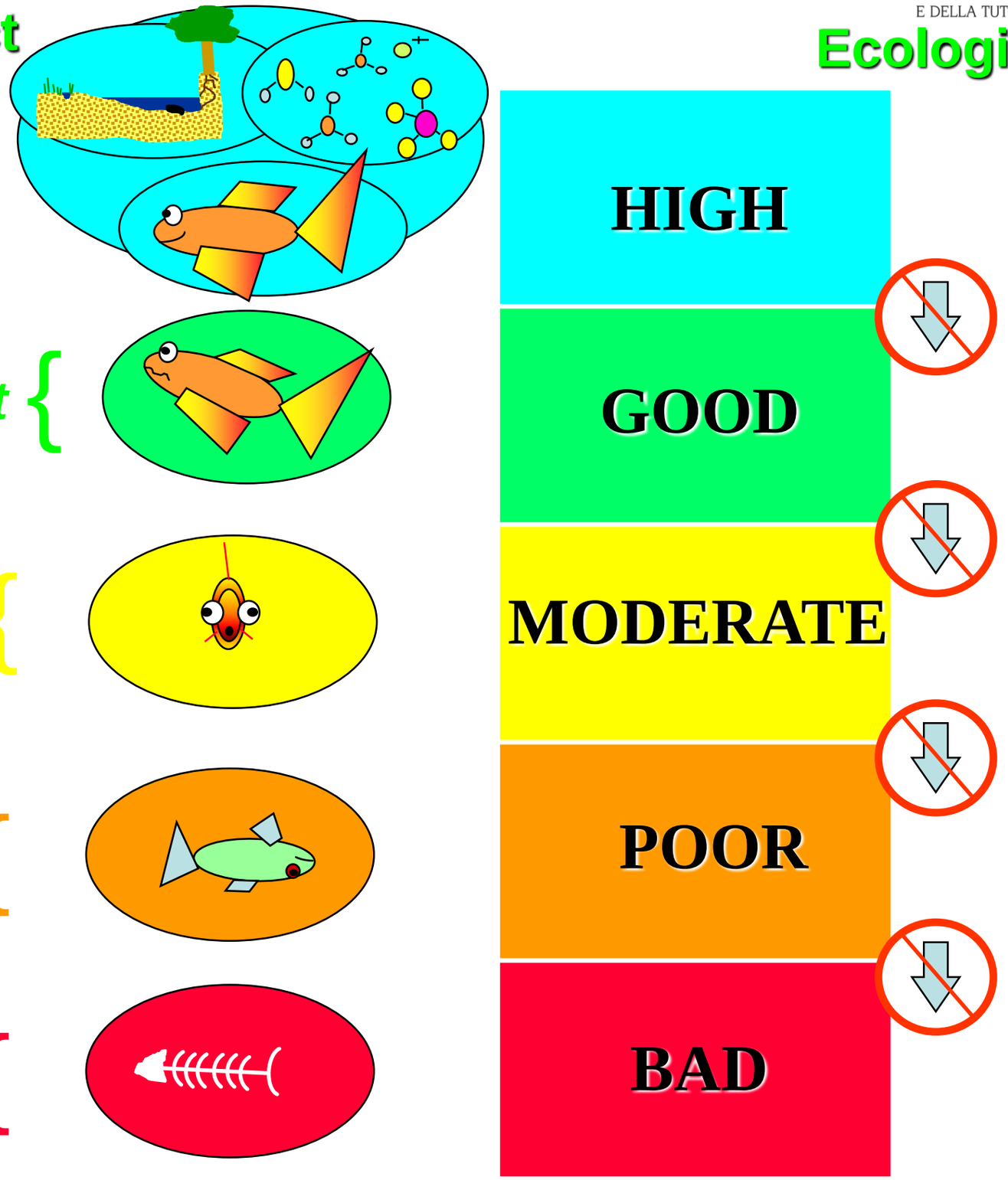
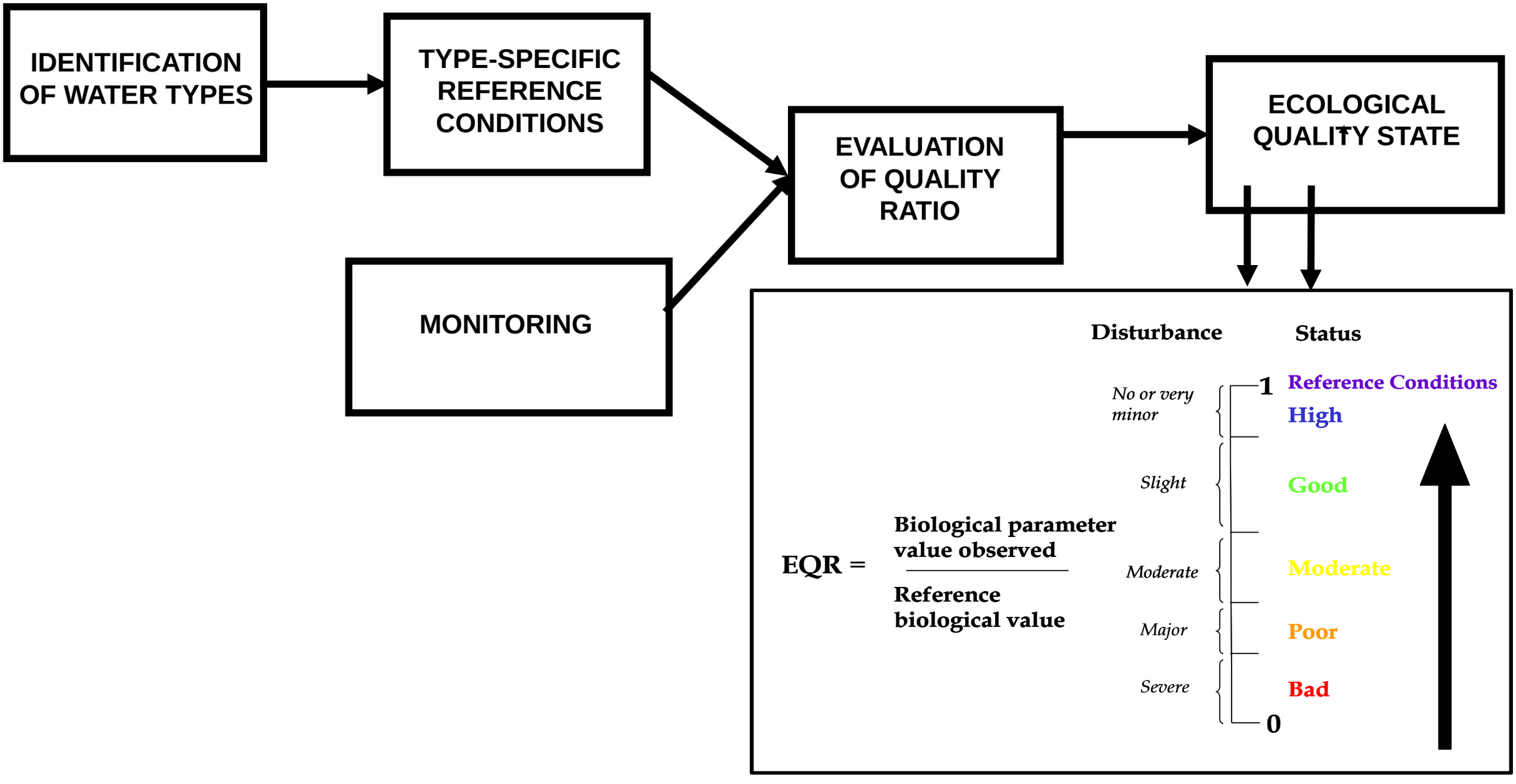


Courtesy Peter Pollard, ScottishEnvironmentProtection Agency

WATER BODIES CLASSIFICATION



Ecological Status of a water body

High status

There are no, or only very minor, anthropogenic alterations to the values of the physico-chemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under **undisturbed conditions**. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion. These are the type-specific conditions and communities

Good status

The values of the biological quality elements for the surface water body type show **low levels of distortion** resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.

Moderate status

The values of the biological quality elements for the surface water body type **deviate moderately from those normally** associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under

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Ecological Status of a water body

Poor status

Waters showing **evidence of major alterations to the values of the biological quality elements** for the surface water body type and in which the relevant biological communities deviate substantially from those normally associated with the surface water body type under undisturbed conditions, shall be classified as poor.

Bad status

Waters showing evidence of **severe alterations to the values of the biological quality elements** for the surface water body type and in which large portions of the relevant biological communities normally associated with the surface water body type under undisturbed conditions are absent, shall be classified as bad

Ecological Status of a water body

To restore and maintain the good quality of water-bodiesit is very important to develop programs that evaluate the **physical, chemical, and biological integrity** of surface waters to improve water quality in rivers, streams and other water-bodies and ensure access to good quality water.

To optimize water environment management strategies **it is important to pay attention to biological monitoring to assess the ecological status of water-bodies.**

Ecosystems are composed of both physical and biological components.

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QUALITYMONITORINGPROGRAMMEOFWATER BODIES

A**Programme for the monitoring of water status,** in order to establish a coherent and comprehensive
overview of water status, shall cover:

- ✓ **for surface waters**:
  - the volume and level or rate of flow to the extent relevant for ecological and chemical status and ecological potential
  - the ecological and chemical status and ecological potential
- ✓ **for groundwater:** monitoring of the chemical and quantitative status
- ✓ **for protected areas:** the programmes shall be supplemented by those specifications contained in Governative legislation under which the individual protected areas have been established.

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QUALITYMONITORINGPROGRAMMEOFWATER BODIES

For the purposes of an initial **characterization of surface water body's types** it is necessary to **identify the location and the boundaries** of surface water categories and carried out an initial characterization. **As first step**, **the water category and the water body type should be used to draw the boundaries resulting in discrete "water bodies".**

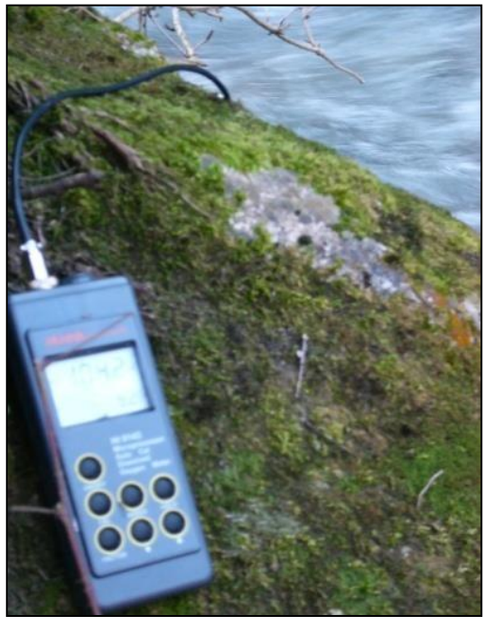
In a **subsequent step, geographical and hydromorphological elements could be considered** and, if such an approach does not lead to a meaningful delineation of "water bodies", other criteria could be used to identify water bodies: as **different uses and status of surface waters, furthermore the pressure and impact analysis may be used for identifying meaningful water body boundaries**

QUALITYMONITORINGPROGRAMMEOFWATER BODIES

The description of a monitoring area should consider as a minimum:

- **definition of the extent of the area**,
- **a summary of the environmental conditions and processes (including human activities) that may affect water quality,**
- **meteorological and hydrological information,**
- **a description of the water bodies**,
- **a summary of actual and potential uses of water**
- **main river and all its tributaries, streams, brooks, ditches, canals, etc., as well as any lakes or ponds that discharge into the river or tributaries**

PhytobenthosSampling



FishSampling

Measurementofsamples

Sampling - Tusciano River

Figura 23: *Esemplare maschio di Trota Fario*

Liberationofsamples

Laboratory Assessment samples phytobenthos

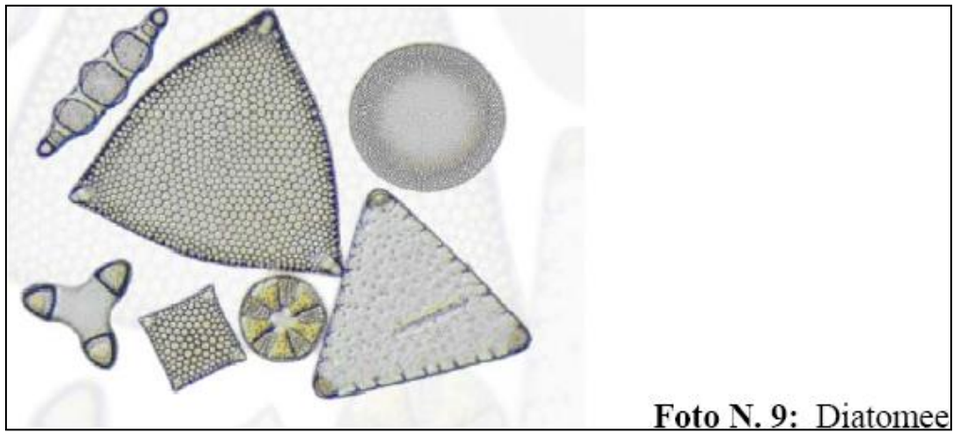
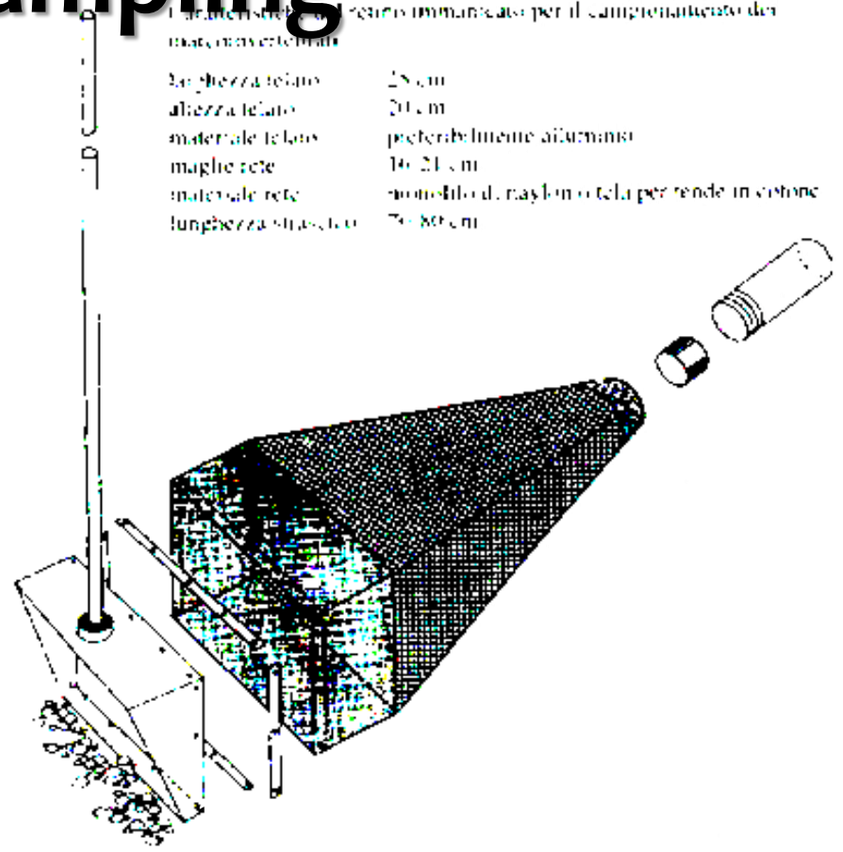


Foto N. 9: Diatomee

MacrobenthosSampling



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MONITORING PROGRAMS

ofsurface water bodies and groundwater

surveillance monitoring: to assess the effects of the measures already established in order to reduce pollution in water bodies and to plan future monitoring programs;

operational monitoring: to assess if a water body is consistent with a quality standard and to assess any changes in water bodies resulting from the programs of measures;

investigative monitoring: when are not clear the reasons for any exceedances of the limits, or if the surveillance monitoring indicates that a water body environmental objectives are unlikely to be achieved or, finally, if there is a type of accidental pollution.

OECD
BETTER POLICIES FOR BETTER LIVES

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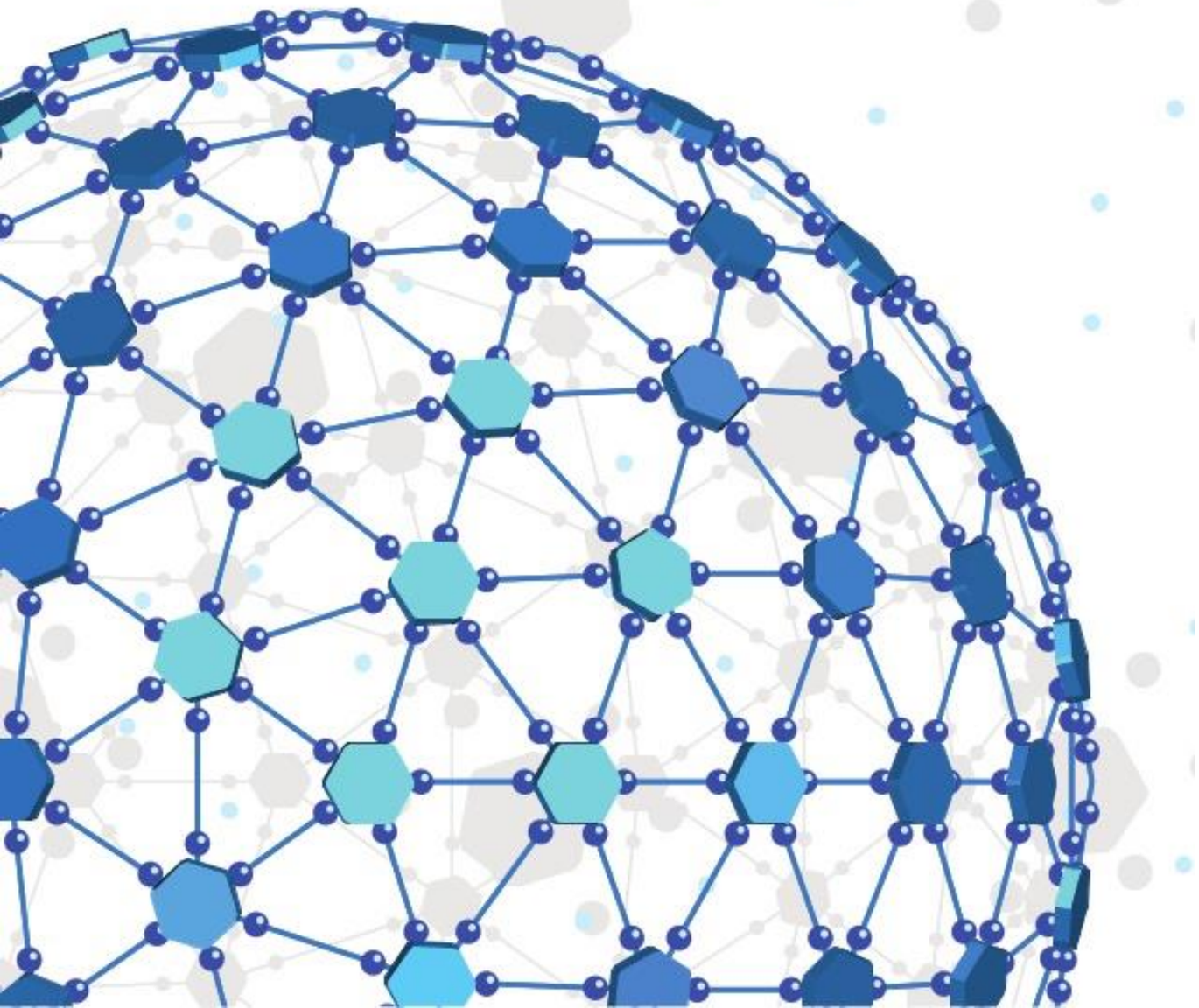
OECD Principles on Water Governance

Welcomed by Ministers at the OECD Ministerial Council Meeting on 4 June 2015

Directorate for Public Governance and Territorial Development



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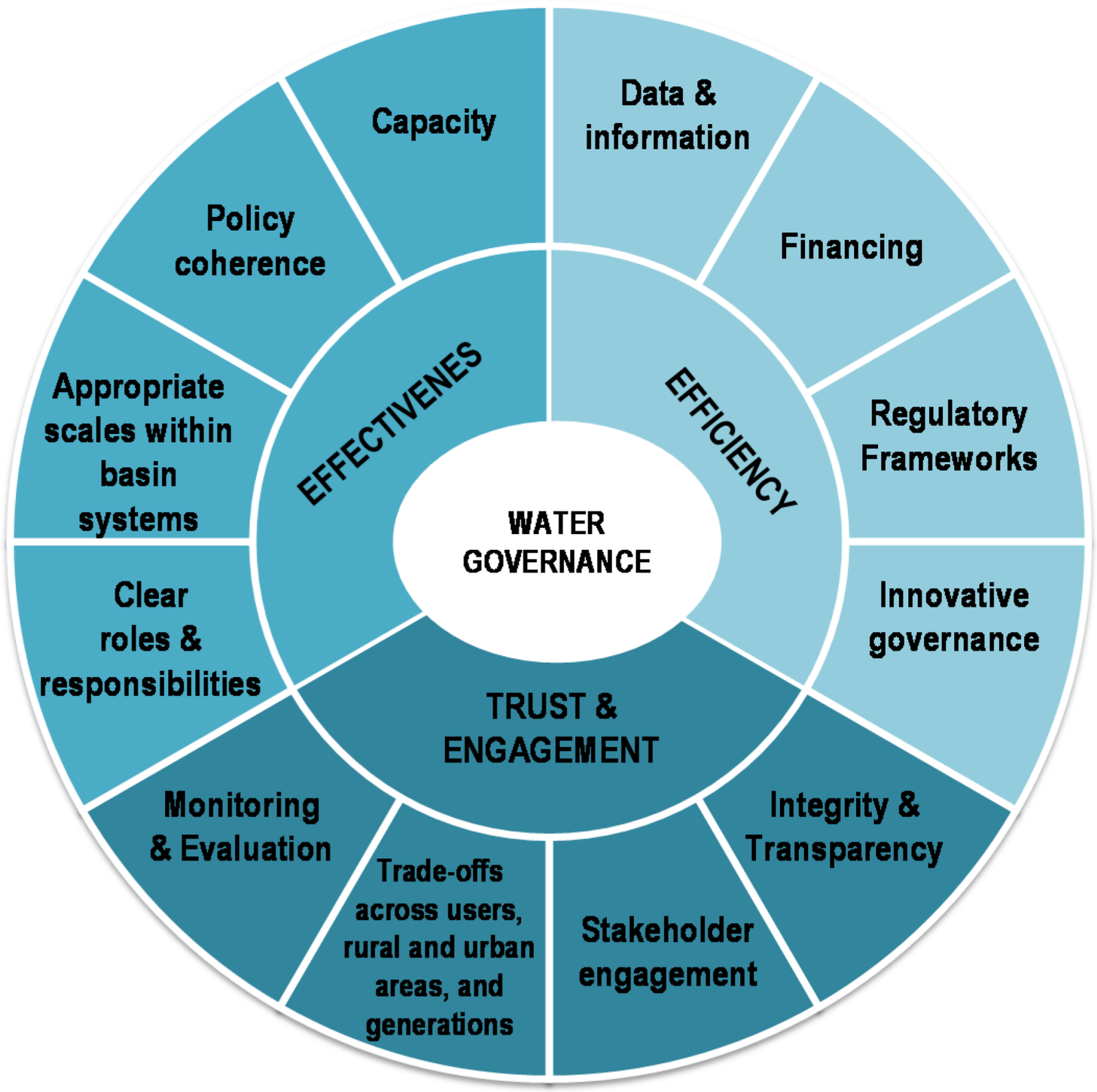

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Enhancing the *effectiveness* of water governance

Principle1. Clearly allocate and distinguish*roles and responsibilitiesfor water policymaking, policy implementation, operational management and regulation, and fosterco-ordinationacrosstheseresponsibleauthorities.*

Tothateffect, legal and institutionalframeworksshould:

a) Specify the allocationofroles and responsibilities, acrossalllevelsofgovernment and water-relatedinstitutions in regardto water

–Policy-making, especiallyprioritysetting and strategic planning;

–Policy implementationespeciallyfinancing and budgeting, data and information, stakeholder engagement, capacitydevelopment and evaluation;

–Operational management, especially service delivery, infrastructureoperation and investment; and

–Regulation and enforcement, especiallytariffsetting, standards, licensing, monitoring and supervision, control and audit, and conflict management;

b) Help identify and addressgaps, overlaps and conflictsof interest throughеffectiveco-ordination at and acrossalllevelsofgovernment.

Principle2. Manage water at the *appropriate scale(s) withinintegratedbasingovernancesystemstoreflectlocalconditions, and fosterco-ordinationbetween the differentscales.*

Tothateffect, water management practices and toolsshould:

a) Respondtolong-termenvironmental, economic and social objectiveswith a viewtomaking the best useof water resources, throughriskprevention and integrated water resources management;
b) Encourage a sound hydrologicalcycle management fromcapture and distributionoffreshwaterto the releaseofwastewater and returnflows;
c) Promoteadaptive and mitigationstrategies, actionprograms and measuresbased on clear and coherentmandates, throughheffectivebasin management plansthat are consistentwithnationalpolicies and localconditions;
d) Promotemulti-levelco-operationamongusers, stakeholders and levelsofgovernmentfor the management of water resources; and,
e) Enhanceriparianco-operation on the useoftransboundaryfreshwater water resources.

Principle 3. Encourage policy coherence through effective *cross-sectoral co-ordination*, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use through:

a)Encouraging co-ordination mechanisms to facilitate coherent policies across ministries, public agencies and levels of government, including cross-sectoral plans;
b)Fostering co-ordinated management of use, protection and clean-up of water resources, taking into account policies that affect water availability, quality and demand (e.g. agriculture, forestry, mining, energy, fisheries, transportation, recreation, and navigation) as well as risk prevention;
c)Identifying, assessing and addressing the barriers to policy coherence from practices, policies and regulations within and beyond the water sector, using monitoring, reporting and reviews; and
d)Providing incentives and regulations to mitigate conflicts among sectoral strategies, bringing these strategies into line with water management needs and finding solutions that fit with local governance and norms.

Principle 4. Adapt the level of *capacity* of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties, through:

a)Identifying and addressing capacity gaps to implement integrated water resources management, notably for planning, rule-making, project management, finance, budgeting, data collection and monitoring, risk management and evaluation;
b)Matching the level of technical, financial and institutional capacity in water governance systems to the nature of problems and needs;
c)Encouraging adaptive and evolving assignment of competences upon demonstration of capacity, where appropriate;
d)Promoting hiring of public officials and water professionals that uses merit-based, transparent processes and are independent from political cycles; and
e)Promoting education and training of water professionals to strengthen the capacity of water institutions as well as stakeholders at large and to foster co-operation and knowledge-sharing

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Enhancing the *efficiency* of water governance

Principle 5. Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related *data and information*, and use it to guide, assess and improve water policy, through:

a)Defining requirements for cost-effective and sustainable production and methods for sharing high quality water and water-related data and information, e.g. on the status of water resources, water financing, environmental needs, socio-economic features and institutional mapping

b)Fostering effective co-ordination and experience sharing among organisations and agencies producing water-related data between data producers and users, and across levels of government;

c)Promoting engagement with stakeholders in the design and implementation of water information systems, and providing guidance on how such information should be shared to foster transparency, trust and comparability (e.g. data banks, reports, maps, diagrams, observatories);

d)Encouraging the design of harmonised and consistent information systems at the basin scale, including in the case of transboundary water, to foster mutual confidence, reciprocity and comparability within the framework of agreements between riparian countries; and

e)Reviewing data collection, use, sharing and dissemination to identify overlaps and synergies and track unnecessary data overload.

Principle 6. Ensure that governance arrangements help mobilise water finance and allocate *financial resources* in an efficient, transparent and timely manner, through:

a)Promoting governance arrangements that help water institutions across levels of government raise the necessary revenues to meet their mandates, building through for example principles such as the polluter-pays and user-pays principles, as well as payment for environmental services;

b)Carrying out sector reviews and strategic financial planning to assess short, medium and long term investment and operational needs and take measures to help ensure availability and sustainability of such finance;

c)Adopting sound and transparent practices for budgeting and accounting that provide a clear picture of water activities and any associated contingent liabilities including infrastructure investment, and aligning multi-annual strategic plans to annual budgets and medium-term priorities of governments;

d)Adopting mechanisms that foster the efficient and transparent allocation of water-related public funds (e.g. through social contracts, scorecards, and audits); and

e)Minimising unnecessary administrative burdens related to public expenditure while preserving fiduciary and fiscal safeguards.

Principle 7. Ensure that sound water management *regulatoryframeworks* are effectively implemented and enforced in pursuit of the public interest,
through:
a)Ensuring a comprehensive, coherent and predictable legal and institutional framework that set rules, standards and guidelines for achieving water policy outcomes, and encourage integrated long-term planning;
b)Ensuring that key regulatory functions are discharged across public agencies, dedicated institutions and levels of government and that regulatory authorities are endowed with necessary resources;
c)Ensuring that rules, institutions and processes are well-co-ordinated, transparent, non-discriminatory, participative and easy to understand and enforce;
d)Encouraging the use of regulatory tools (evaluation and consultation mechanisms) to foster the quality of regulatory processes and make the results accessible to the public, where appropriate;
e)Setting clear, transparent and proportionate enforcement rules, procedures, incentives and tools (including rewards and penalties) to promote compliance and achieve regulatory objectives in a cost-effective way; and
f)Ensuring that effective remedies can be claimed through non-discriminatory access to justice, considering the range of options as appropriate.

Principle 8. Promote the adoption and implementation of *innovative water governance practices* across responsible authorities, levels of government and relevant stakeholders, through:

a)Encouraging experimentation and pilot-testing on water governance, drawing lessons from success and failures, and scaling up replicable practices;
b)Promoting social learning to facilitate dialogue and consensus-building, for example through networking platforms, social media, Information and Communication Technologies (ICTs) and user-friendly interface (e.g. digital maps, big data, smart data and open data) and other means;
c)Promoting innovative ways to co-operate, to pool resources and capacity, to build synergies across sectors and search for efficiency gains, notably through metropolitan governance, inter-municipal collaboration, urban-rural partnerships, and performance-based contracts; and
d)Promoting a strong science-policy interface to contribute to better water governance and bridge the divide between scientific findings and water governance practices.

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Enhancing *trust and engagement* in water governance

Principle 9. Mainstream *integrity and transparency* practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making, through:

a)Promoting legal and institutional frameworks that hold decision-makers and stakeholders accountable, such as the right to information and independent authorities to investigate water related issues and law enforcement ;
b)Encouraging norms, codes of conduct or charters on integrity and transparency in national or local contexts and monitoring their implementation;
c)Establishing clear accountability and control mechanisms for transparent water policy making and implementation ;
d)Diagnosing and mapping on a regular basis existing or potential drivers of corruption and risks in all water-related institutions at different levels, including for public procurement; and
e)Adopting multi-stakeholder approaches, dedicated tools and action plans to identify and address water integrity and transparency gaps (e.g. integrity scans/pacts, risk analysis, social witnesses)

Principle 10. ***Promote stakeholder engagement*** **for informed and outcome-oriented contributions to water policy design and implementation,** through:

a)Mapping public, private and non-profit actors who have a stake in the outcome or who are likely to be affected by water-related decisions, as well as their responsibilities, core motivations and interactions;
b)Paying special attention to under-represented categories (youth, the poor, women, indigenous people, domestic users) newcomers (property developers, institutional investors) and other water-related stakeholders and institutions;
c)Defining the line of decision-making and the expected use of stakeholders' inputs, and mitigating power imbalances and risks of consultation capture from over-represented or overly vocal categories, as well as between expert and non-expert voices;
d)Encouraging capacity development of relevant stakeholders as well as accurate, timely and reliable information, as appropriate;
e)Assessing the process and outcomes of stakeholder engagement to learn, adjust and improve accordingly, including the evaluation of costs and benefits of engagement processes;
f)Promoting legal and institutional frameworks, organisational structures and responsible authorities that are conducive to stakeholder engagement, taking account of local circumstances, needs and capacities; and
g)Customising the type and level of stakeholder engagement to the needs and keeping the process flexible to adapt to changing circumstances.

Principle 11. Encourage water governance frameworks that help manage *trade-offs* across water users, rural and urban areas, and generations, through:

a)Promoting non-discriminatory participation in decision-making across people, especially vulnerable groups and people living in remote areas;
b)Empowering local authorities and users to identify and address barriers to access quality water services and resources and promoting rural-urban co-operation including through greater partnership between water institutions and spatial planners;
c)Promoting public debate on the risks and costs associated with too much, too little or too polluted water to raise awareness, build consensus on who pays for what, and contribute to better affordability and sustainability now and in the future; and
d)Encouraging evidence-based assessment of the distributional consequences of water-related policies on citizens, water users and places to guide decision-making.

Principle 12. Promote regular *monitoring and evaluation* of water policy and governance where appropriate, share the results with the public and make adjustments when needed, through:

a)Promoting dedicated institutions for monitoring and evaluation that are endowed with sufficient capacity, appropriate degree of independence and resources as well as the necessary instruments;
b)Developing reliable monitoring and reporting mechanisms to effectively guide decision-making;
c)Assessing to what extent water policy fulfils the intended outcomes and water governance frameworks are fit for purpose; and
d)Encouraging timely and transparent sharing of the evaluation results and adapting strategies as new information become available.

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http://www.oecd.org/env/watergovernanceprogramme.htm

THANK YOU

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