



Control of Invasive Alien Species in Guadalquivir River Basin

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CONFEDERACIÓN
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GUADALQUIVIR

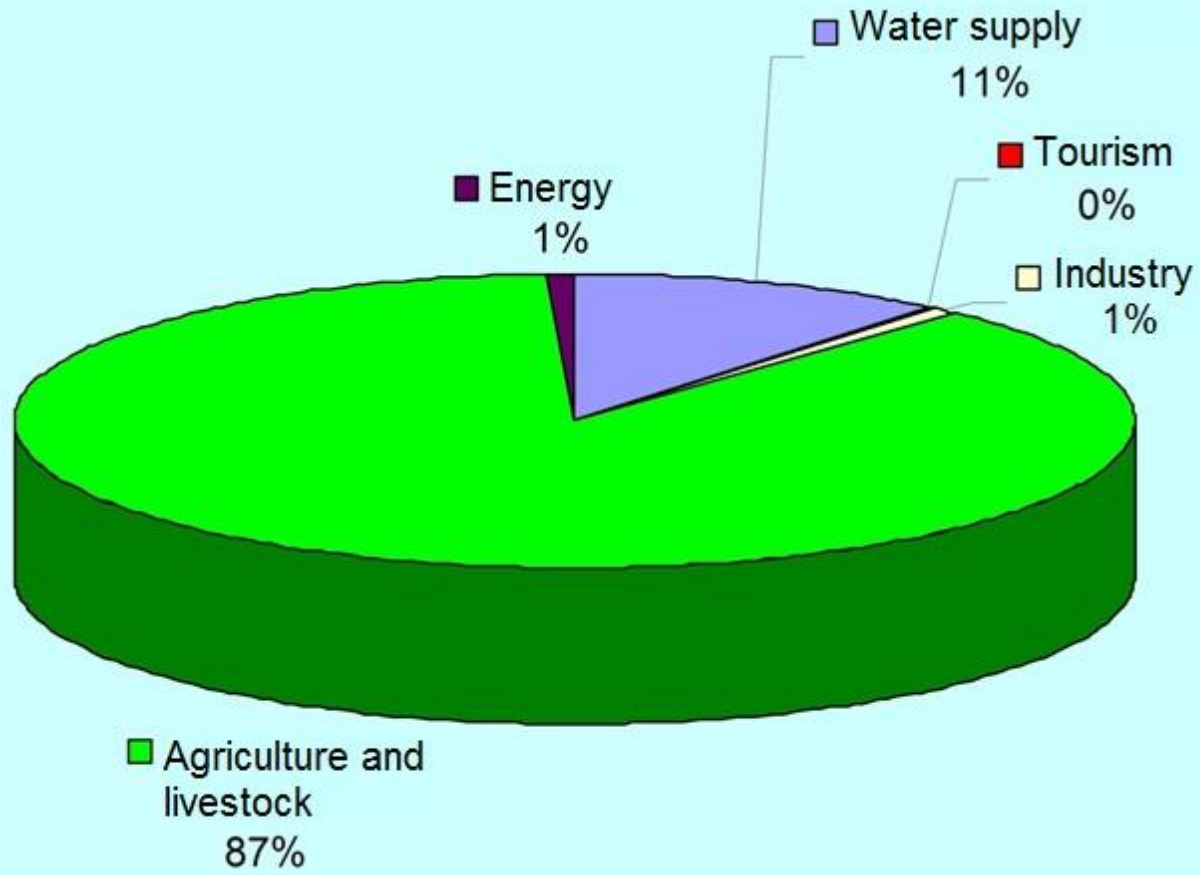
GUADALQUIVIR RIVER BASIN

Total surface: 57 527 km².
 4 regions/ 12 provinces



| Region | Geographical surface in the basin |
|--------------------|-----------------------------------|
| Andalucía | 51 900 km ² |
| Castilla La Mancha | 4 100 km ² |
| Extremadura | 1 411 km ² |
| Murcia | 116 km ² |
| TOTAL | 57 527 km² |

WATER CONSUMPTION



ALIEN SPECIES IN THE WATERSHED

| SCIENTIFIC NAME | COMMON NAME |
|--|--|
| PLANTS AND ALGAE | |
| <i>Arundo donax</i> | Giant reed, giant cane or Spanish cane |
| <i>Azolla</i> spp. | mosquito fern, duckweed fern, fairy moss or water fern |
| <i>Egeria densa</i> | Large-flowered waterweed or Brazilian waterweed |
| NON ARTHROPOD INVERTEBRATES | |
| <i>Dreissena polymorpha</i> | Zebra mussel |
| <i>Corbicula fluminea</i> | Asian clam, golden freshwater clam or prosperity clam (in SE Asia) |
| <i>Mytilopsis leucophaeta</i> | Conrad's false mussel, dark false mussel or false zebra mussel |
| <i>Paludicella articulata</i> , <i>Urnatella gracilis</i> and <i>Plumatella</i> spp. | Bryozoans or moss animals |
| CRUSTACEANS | |
| <i>Procambarus clarkii</i> | Red swamp crayfish, American crayfish or Louisiana crawfish |
| <i>Pacifastacus leniusculus</i> | Signal crayfish |
| <i>Eriocheir sinensis</i> | Chinese mitten crab or Shanghai hairy crab |
| FISHES | |
| <i>Alburnus alburnus</i> | Common bleak |
| <i>Ameiurus melas</i> | Black bullhead or black bullhead catfish |
| <i>Esox lucius</i> | Pike or Northern pike |
| <i>Gambusia holbrooki</i> | Eastern mosquitofish |
| <i>Lepomis gibbosus</i> | Pumpkinseed, sunfish or pond perch |
| <i>Micropterus salmoides</i> | Largemouth bass or black bass |
| <i>Silurus glanis</i> | Wels catfish or sheatfish |

Hey, one moment! Not that fast!

What's an "alien, exotic or allochthonous" species?



"It is any species that is not native or indigenous to a particular area". So, the adjective "alien" is always referred to a particular place (to a biogeographical sector/ province/ region/ reign...). E.g., "lions are alien to the Eurosiberian region".

And what's an
"invasive"
alien species?



It is an alien species that adversely impacts upon the local ecosystem where it has been (deliberately or accidentally) introduced and/or upon human welfare. This always implies a high capability to settle and spread.



The zebra mussel
(*Dreissena polymorpha*)

IMPORTANT CHARACTERISTICS

Origin: Ponto-Caspian region (basins around Caspian, Aral and Black seas).

| Environmental factor | Requirements | |
|-------------------------------------|-----------------------------|----------|
| Water speed | <1.5 m/s | |
| Water temperature | Survival | 0-32 °C |
| | Growth | 10-30 °C |
| | Reproduction | >12 °C |
| Depth | 2-14 m | |
| Dissolved O ₂ saturation | >25 % (several days anoxia) | |
| Dissolved Ca concentration | >12 mg/L | |
| pH | 7.3-9.0 (optimal 8.4) | |
| Survival outside the water | 8-10 days | |
| Salinity | < 5 psu | |

That is a relatively wide range of tolerance

REPRODUCTION:

- **Dioecius species** (there are males and females). Sex ratio about 1:1.
- **One million eggs per female.**
- **Fast life cycle:** four weeks.
- **Life cycle includes planctonic phases.**

ALL THIS MEANS:

- Very high potential for spreading.
- Very difficult to take effective control actions.

IMPACTS:

ECOLOGICAL

- Phyto and microzooplankton decrease.
- Macrophyta increase.
- Accumulation of organic and inorganic residues in the bed of the reservoir.
- Relocation of most energy and matter movements from the water column to the bottom. Alteration of nutrient cycles.
- Increases transparency of water.
- Severe decrease of autochthonous bivalves.
- Reduction of fishes biomass.
- Bioaccumulation and biomagnification of toxics (heavy metals, organic pollutants), and transference of them to higher trophic strata.
- Source of food for birds. Migratory habits perturbation and, therefore, it causes impacts thousands of kilometres away.

IMPACTS:

ECONOMIC AND SOCIAL

- **It fixes on any non-toxic surface**, what causes clog up of grids, pipes and pumping systems; malfunction or poor performance of hydraulic turbines; damages in cooling systems of ship motors, and it covers boats hulls (increases fuel consumption).
- In touristic areas, shells can cause **lacerations in bathers' feet**.
- **Sailing limitations or bans** imposed to avoid further propagation of the mussel can result in additional loss of tourist appeal.
- **Distortion** of results provided by **automatic measuring devices**, or complete annulment of these ones.

It is considered by IUCN **one of the 100 most harmful invasive species**.



SPREAD IN THE RIVER BASIN

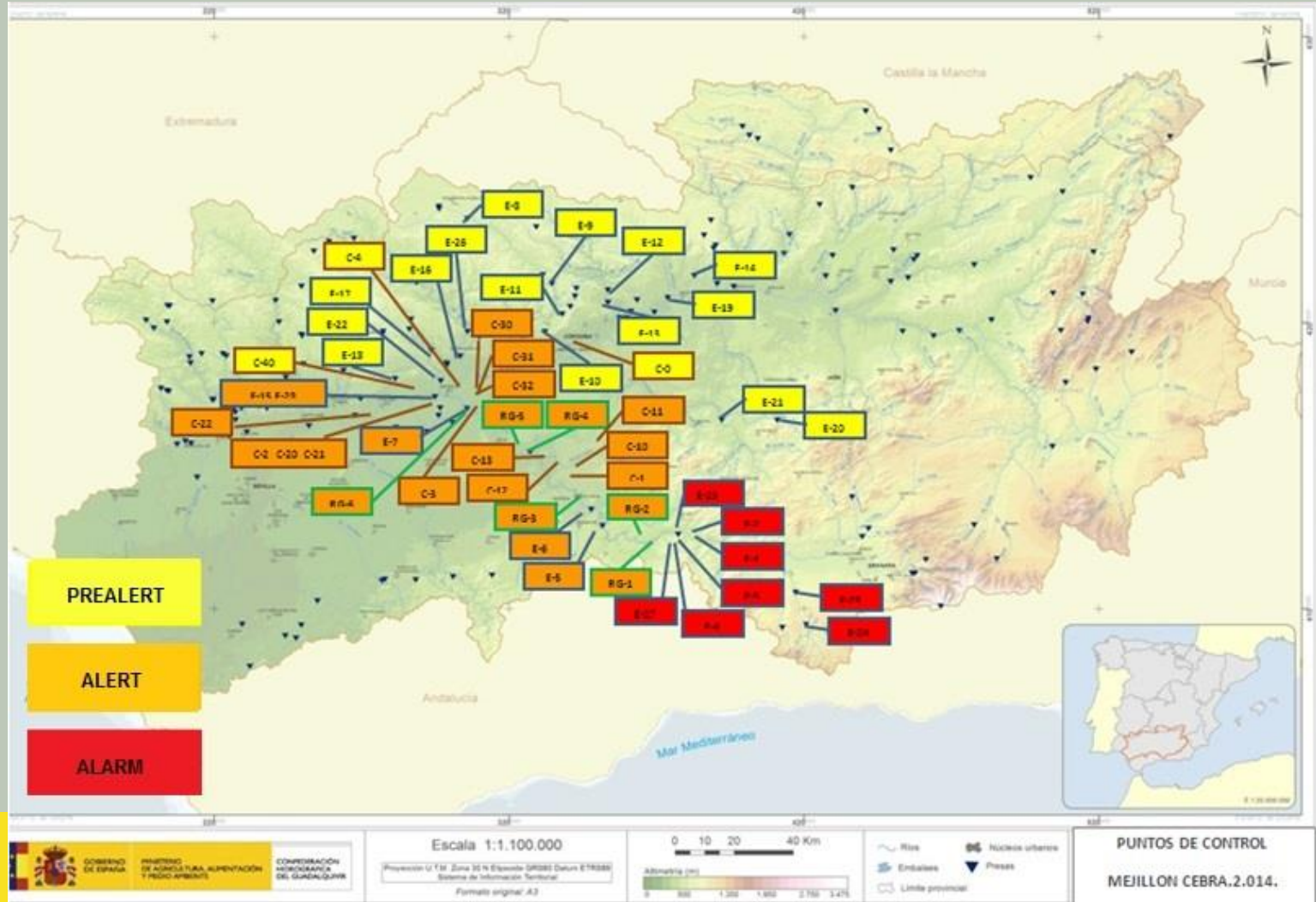
Reservoirs classification, according to the degree of settlement of zebra mussel and susceptibility to be colonised.

| | |
|-----------------|--|
| PREALERT | Water bodies without any presence of zebra mussel, neither adults nor larvae. Moreover, these water bodies are not located downstream reservoirs where larvae and/or adults have been detected. |
| ALERT | Water bodies where larvae and/or adult individuals of zebra mussel have been found occasionally, or they are downstream of other water bodies where presence of larvae and/or adults has been found. |
| ALARM | Water bodies with confirmed and reiterated presence of adults and larvae of zebra mussel. |



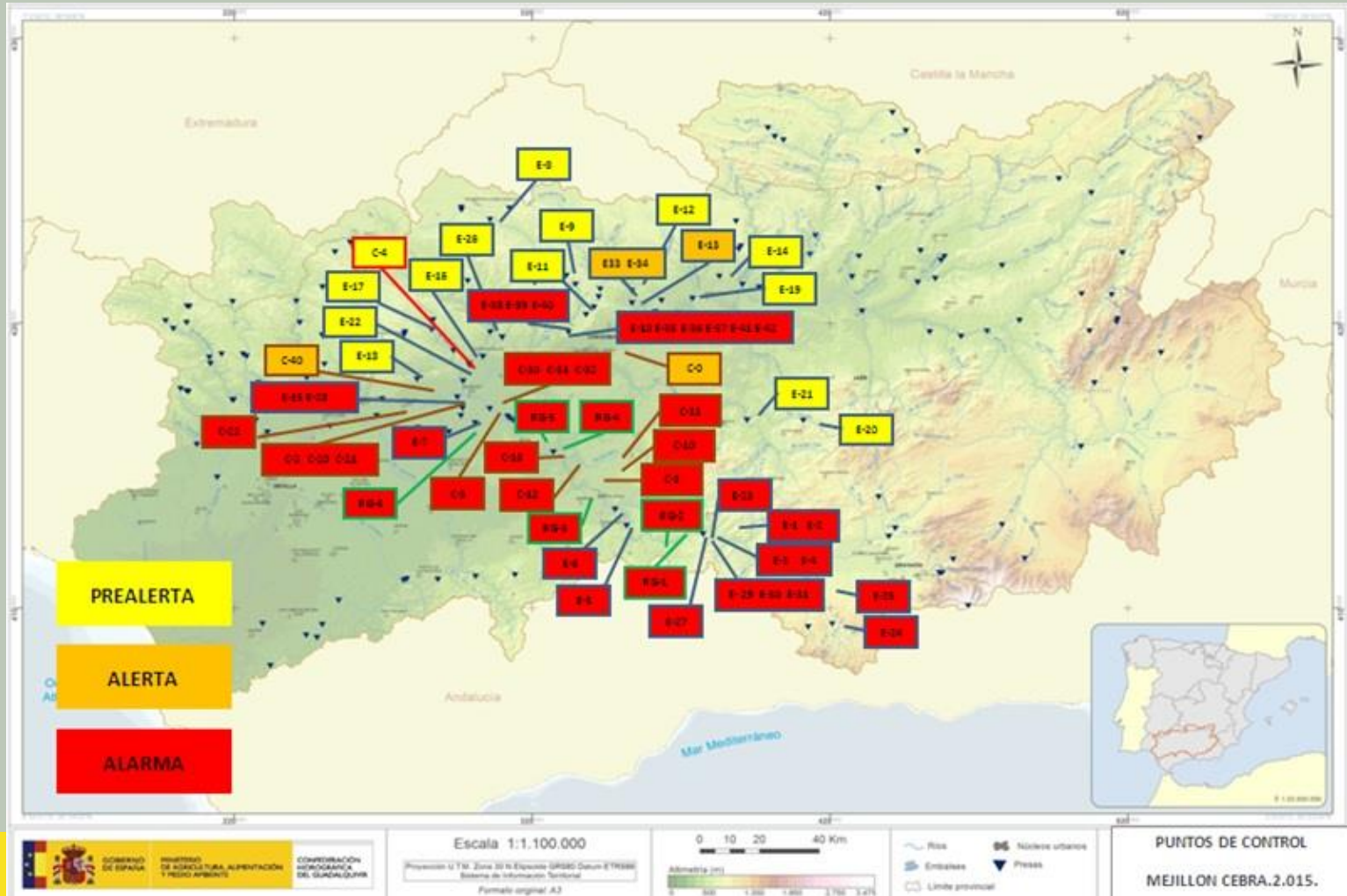
PRESENCE OF ZEBRA MUSSEL IN GUADALQUIVIR WATERSHED.

Prealert, alert and alarm states. Year 2014



PRESENCE OF ZEBRA MUSSEL IN GUADALQUIVIR WATERSHED.

Prealert, alert and alarm states. Year 2015



CONTROL MEASURES:

- **Navigation:**
 - Restrictions, rules, confinement and bans.
 - Accesses enablement and control.
- **Technical advisory** on usage of biocides (sodium hypochlorite, sodium bisulphite...) to protect facilities:
 - To irrigation communities.
 - To hydroelectric power plants.
- **Technical advisory** on usage of mobile disinfection stations, to be used after navigation in reservoir where the mussel has been detected, if you want to navigate in a different reservoir with that ship.
- **Awareness and education campaigns.**

MONITORING MEASURES:

- **Semi-continuous** monitoring.
- **Sampling** campaigns.





ESPECIES EXÓTICAS INVASORAS

MEJILLÓN CEBRA

(Dreissena polymorpha)

Considerada como una de las especies exóticas invasoras más perjudiciales del planeta. Este molusco bivalvo de aguas dulces y salobres, originario del mar Negro y Caspio. Detectado por primera vez en septiembre de 2001 en el río Ebro, actualmente se extiende ampliamente por ríos, lagos y embalses de la geografía española en las comunidades autónomas de Cataluña, Castilla y León, La Rioja, Navarra, País Vasco, Comunidad Valenciana y Andalucía.

DESCRIPCIÓN:

- Molusco bivalvo.
- Concha en forma triangular con franjas claras y oscuras en forma de zigzag.
- Tamaño de 1 a 4,5 cm de longitud.
- Se sujeta a sustratos duros mediante un bicho formando grandes extensiones masivas.
- Resiste bien la salinidad aunque prefiere aguas estancadas o con poca corriente.

BIOLOGÍA:

- Reproducción sexual externa, puede tener lugar en primavera y verano. Requiere a producir de 90.000 a un millón de larvas por individuo y año.
- Ciclo de vida en dos fases:

-FASE LARVARIA: Planotónica, flotante, vive libre en las aguas y se deja arrastrar por las corrientes. De 14 a 21 días de duración, llevada al río Hozarri, es el factor más importante con el que cuenta para su dispersión.

-FASE ADULTA: Fija a un sustrato, pueden tener una densidad de hasta 750.000 individuos por metro cuadrado. Pueden vivir hasta 7 años y laboran bien la exposición al aire durante 8-10 días antes de morir.

¿CÓMO SE DISPERSA?

Larvación recreativa y orientada a la pesca deportiva se considera como el mayor vector de la gran expansión del mejillón cebra.

EN SU FASE ADULTA es transportado adherido a los cascos de las embarcaciones.

EN SU FASE LARVARIA es transportado en la agua de lastre, orositos, sentinas, motores, mangueras, aves de pesca o cualquier otro elemento en contacto con agua infestada.

DISTRIBUCIÓN EN LA CUENCA DEL GUADALQUIVIR

En la cuenca del Guadalquivir, los primeros individuos se detectan en el año 2007 en el embalse de Barregales y en 2011 en el embalse de Izárriz.

Tras el seguimiento de la especie realizado en 2014 por la Confederación Hidrográfica del Guadalquivir se tiene un conocimiento global de la magnitud de la invasión de la especie.

LOCALIZACIÓN:

- Embalse Barregales.
- Embalse Izárriz.
- Embalse de La Breña I.
- Comunidades de regantes desde Genil-Cabra hasta Bajo Guadalquivir, pasando por Vale Interior del Guadalquivir.

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Conoce las especies invasoras

Estaciones limpieza

Descargas

Actuaciones

Divulgación

Noticias

Colabora

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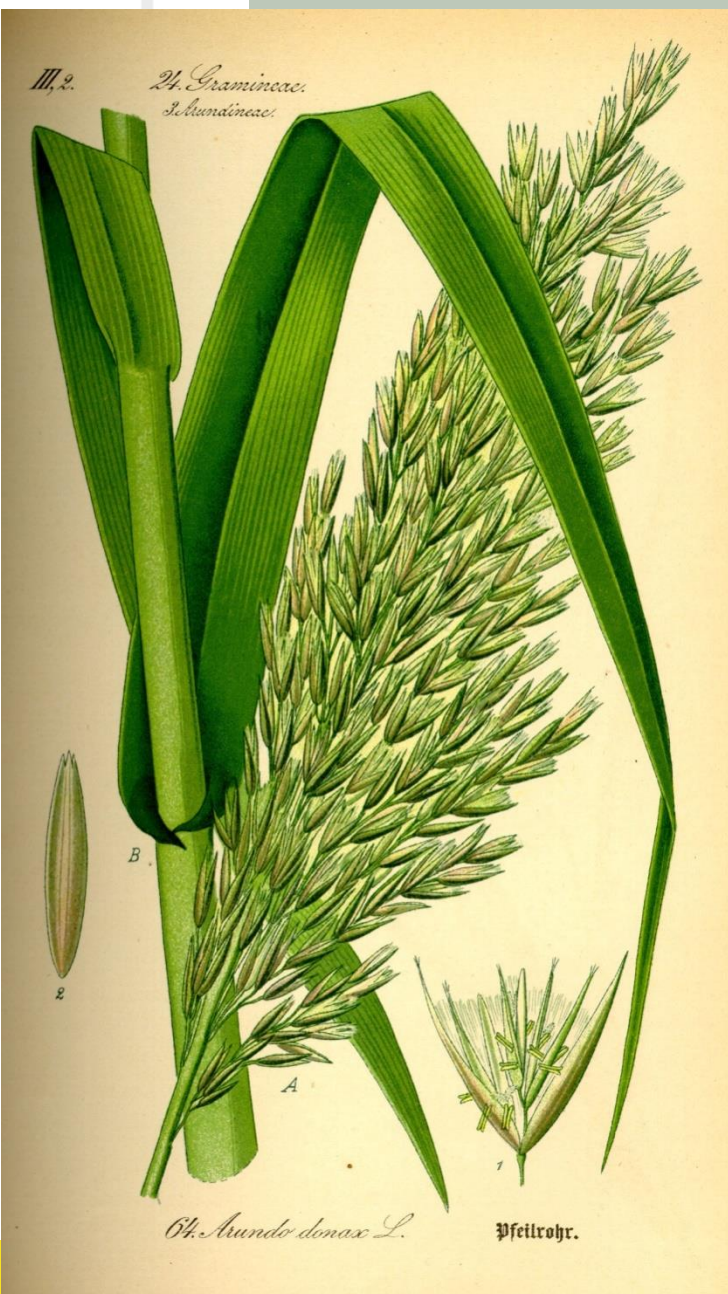
Colabora

The giant cane (*Arundo donax*)

Origin: Central Asia.

Situation in Spain: in most provinces, but specially in the South, in the East and in Canary and and Balearic Islands.

It is considered by IUCN **one of the 100 most harmful species**, in respect of its invasiveness and capacity to disturb colonised habitats.



IMPORTANT CHARACTERISTICS:

- **Perennial.**
- **Extensive rhizomes.** Deep roots.
- Up to 5 m height. Hard hollow stems.
- Only **asexual reproduction**, except in its area of origin:
 - Rhizomes. Even very small pieces, of 1 cm or larger, can produce new roots and stems.
 - Stems. When they fall, they produce new roots and stems. Small pieces, over 2 cm, can germinate.
- **Hydrophilic.** It lives by rivers and wetlands.
- Tolerates **very high summer temperatures**, but only **moderately low winter temperatures**.



IMPACTS:

- **Changes in the riverbed.**
 - In small rivers and creeks, the constriction of the riverbed is big. So, it increases the risk of overflows and floods.
 - In big rivers where the loss of hydraulic section is not significant, it can be positive for flood abatement.
- **Increases risk of fire.**
- Autochthonous vegetation is displaced. Giant cane tends to form monospecific masses. So, although it provides some habitat and food for animals, **the ecosystem suffers a general impoverishment and biodiversity loss**, when compared with the native community.

CONTROL MEASURES

- 80-120 public requests per year (from town halls) to remove canes from streams.
 - More than 200 private requests.
- **Simple cut down:** the problem will recur next year (probably more seriously) due to the extremely high regeneration capability of the cane.
 - **Cut down and uproot:** to be effective, it requires to repeat the action five consecutive years, what is expensive.
 - **Plastic covers:** effective, but expensive for large areas and causes other impacts.
 - **Cut down, unroot and dense cover with live *Salix sp.*** branches and stems. Effective, but expensive.
 - **Herbicides:** in most cases, application must be carried out plant by plant; otherwise, may cause other impacts. Effective, but expensive.
 - **Residues management:** it must be very careful, because small pieces of rhizome (> 1 cm) and stem (> 2 cm) can germinate.

Conclusions

1. There are **many** invasive alien species.
2. They **spread very quickly**.
3. They cause important ecological and socio-economic **damages**.
4. If they settle, it is **practically impossible to eradicate** them, and **very difficult to prevent further expansion**.

Should we include among the **water quality indicators** of the Water Frame Directive, anyone related to **invasive species**?



THANK YOU VERY MUCH!

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- **Verónica Gros:** vgros@chguadalquivir
- **General information on invasive species:** stop.invasoras@chguadalquivir.es



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