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The Role of Ecophysiological Studies on Invasive Plants Tolerance to Abiotic Stress in Conservation Programmes

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INTRODUCTION

Invasive alien species (IAS)have been recognised for several decades as **one of the main challenges** to threatened plants, second only to habitat loss. Already at the beginning of this century**, 57% of threatened species were reported to be negatively affected by non-native competitors.**

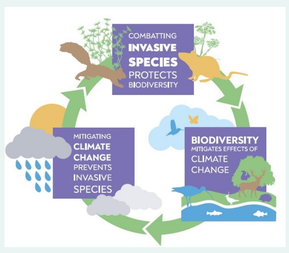
How do invasive species invade new hábitats?

Disrupt the functioning of ecosystems and services.

- **Resilient to environmental change (Generalist Traits)**
- **Compete with native species**
- **High reproduction rate and rapid dispersion**
- **Alter soil composition, nutrient, nitrogen and hydrological cycles**
- **Suppress growth of others using biochemicals**
- **Lack of natural predators**

What is the main problem?

The **establishment** of IAS worldwide is not slowing down and **is even expected to increase** despite prevention measures.



Climate change effects and plant invasions are closely related. The risk of biological invasions is very high in the Mediterranean region, where climate conditions may be drastically affected by global warming. IAS frequently exhibit high levels of stress tolerance in addition to their capacity to outcompete native flora. These traits, along with effective dispersal techniques, are crucial to guaranteeing their continued global expansion, particularly in regions affected by climate change.

STRESS TOLERANCE MECHANISMS

The ability of plants to withstand abiotic stresses such as drought, salt, and high temperatures is based on the **activation of defense mechanisms:**

- ✓ **Osmotic regulation**
- ✓ **Stomatal control**
- ✓ **Root adaptations**
- ✓ **Leaf morphological changes**
- ✓ **Antioxidant defense**
- ✓ **Ion homeostasis**
- ✓ **Heat shock proteins**
- ✓ **Metabolic adjustments**
- ✓ **Regulation of hormones**
- ✓ **Cell wall reinforcement**

Therefore, **the analysis of the limits of tolerance to abiotic stresses of invasive plants and the efficiency of their response mechanisms may help predicting their potential invasiveness**; and thus, becoming a **side tool to improve decision making in conservation programmes of native vegetation.**

HUMAN-DRIVEN PLANT INVASIONS

The main source of plant invasions is anthropic activities:

- **Intentionally**: Ornamental horticulture
- **Unintentionally**: By non-deliberately means, such as by dispersion (e.g., ships, planes, etc)

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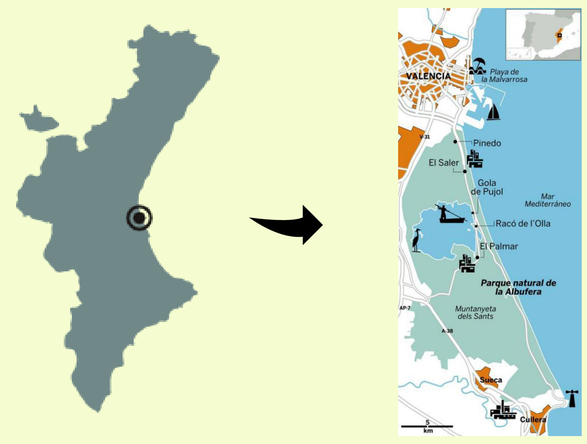
OBJECTIVE

Analyse the **tolerance to abiotic stress** of some of the most problematic IAS in the **Natural Park of L' Albufera in València (Spain).**

Most of these IAS have an outstanding tolerance to environmental constraints, especially to drought and salinity. Most of them activate several aspects of the biochemical mechanisms that allow them to flourish and compete under stressful conditions.

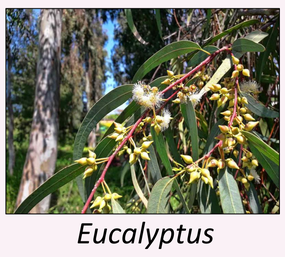
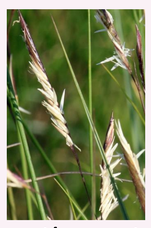
STUDY AREA

L'Albufera Natural Park (València, Spain)



MAIN INVASIVE ALIEN SPECIES (IAS) & TOLERANCE MECHANISMS

Woody species	Saltmarshes	Dunes	Other (Garden scapees)
Acacia saligna *Eucalyptus camaldulensis*	*Arundo donax* *Spartina patens*	*Carpobrotus* sp.pl. *Alloe* sp.pl.	*Cortaderia selloana* *Lantana camara* *Oenothera biennis*

	Drought Tolerance	Salinity Tolerance
 *Acacia saligna*	• Deep root systems • Reduction of water loss through transpiration (modifying leaf) • High water-use efficiency	• Osmotic adjustment • Ion homeostasis
 *Eucalyptus camaldulensis*	• Water-use adjustment • Stomatal closure • Modification of leaf orientation to reduce transpiration • Deep root system • Osmolyte accumulation	Is sensitive to high soil salinity.
 *Spartina patens*	Not particularly well-suited to extended drought conditions.	• Salt excretion • Compartmentalization of ions • Osmotic adjustment
 *Arundo donax*	• Extensive root system • Reduction of water loss by transpiration and stomatal closure • Osmolyte accumulation	• Osmolyte accumulation • Ion homeostasis
 *Carpobrotus sp.pl.*	• Osmotic adjustment • Stomatal regulation • Deep root systems • Xerophytic leaf characteristics • Reduction in growth	• Ion root exclusion • Ion compartmentalization • Osmotic adjustment • Salt tolerant proteins
 *Cortaderia selloana*	• Deep root system • Reduced transpiration • Water storage • Xerophytic leaf traits	Not well-adapted to saline environments

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