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Application of different techniques for restoration of disturbed habitats

Protecting biodiversity in Sicily-Malta Natura 2000 sites through Seed Banks and population reinforcements

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Defining a disturbed habitat

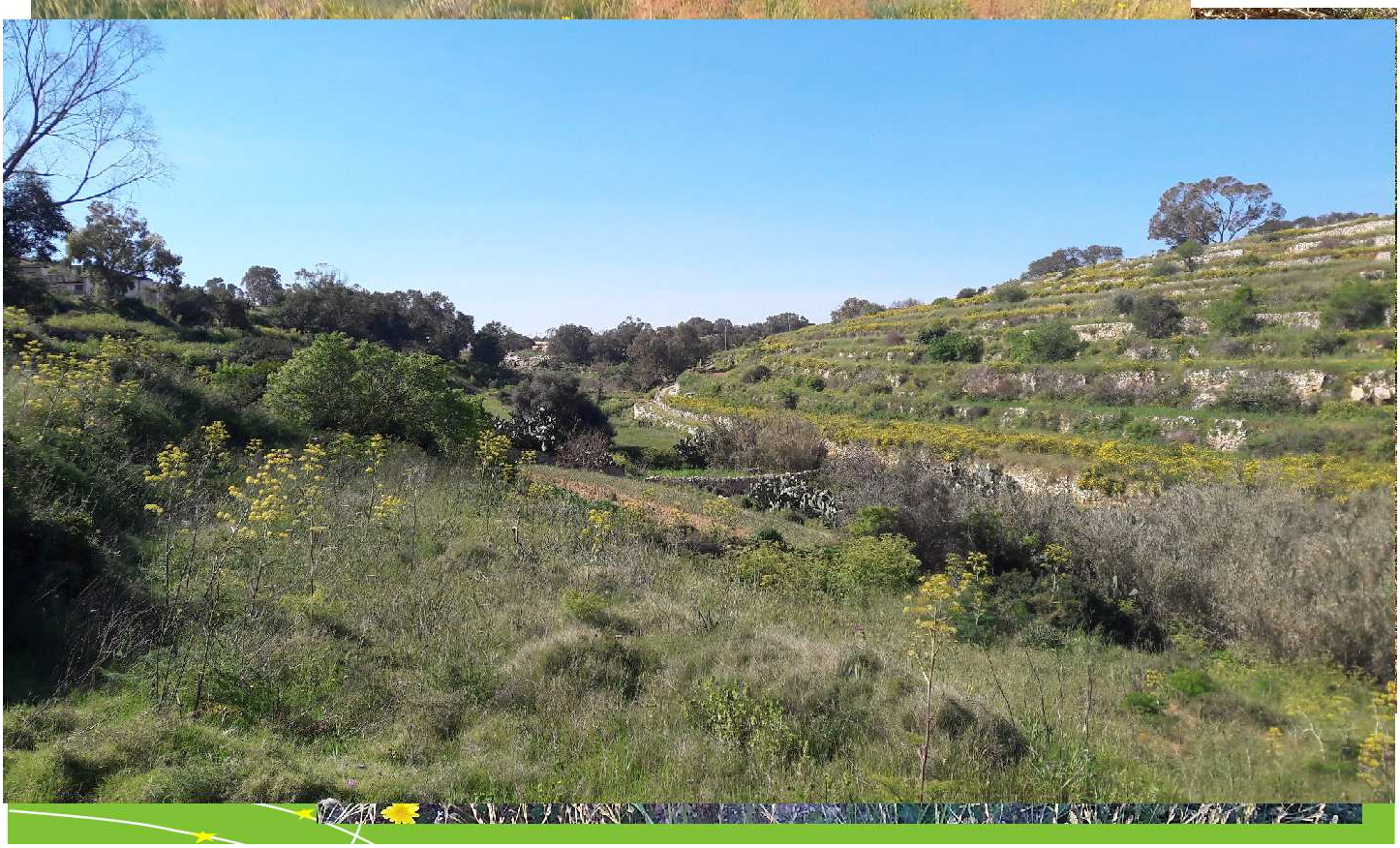
What are disturbed habitats? Disturbed habitats refer to an ecological concept indicating a change in environmental conditions which causes a pronounced change in conditions of an ecosystem, which interferes with its normal function and extensively alters natural communities.

What are the characteristics of disturbed habitats? Disturbed habitats are often characterised by the presence of extensive areas of **ruderal species**, or **unchecked spread of invasive alien species**. Another characteristic is the reduction or even complete displacement of indigenous flora.

Causes of habitat disturbance

- **Anthropogenic disturbances** resulting from trampling, overgrazing, illegal fly tipping.
- **Invasive alien species** that have taken over and increased their range.
- **Vegetation denudation** from uncontrolled erosion due to trampling & overgrazing; accidental fire, chemical spraying; pests and disease.
- **Catastrophic climate events** - periods of drought, floods, hail damage, persistent heat or cold stress resulting in extensive fires or dieback or insect outbreaks.

Problem of ruderal species



Problem of Invasives

Cardiospermum halicacabum – Balloon Vine

Agave americana & Agave sisalana

Carpobrotus acinaciformis – Hotentot Fig

Pennisetum setaceaum – Fountain Grass

Undertaking actions on disturbed habitats

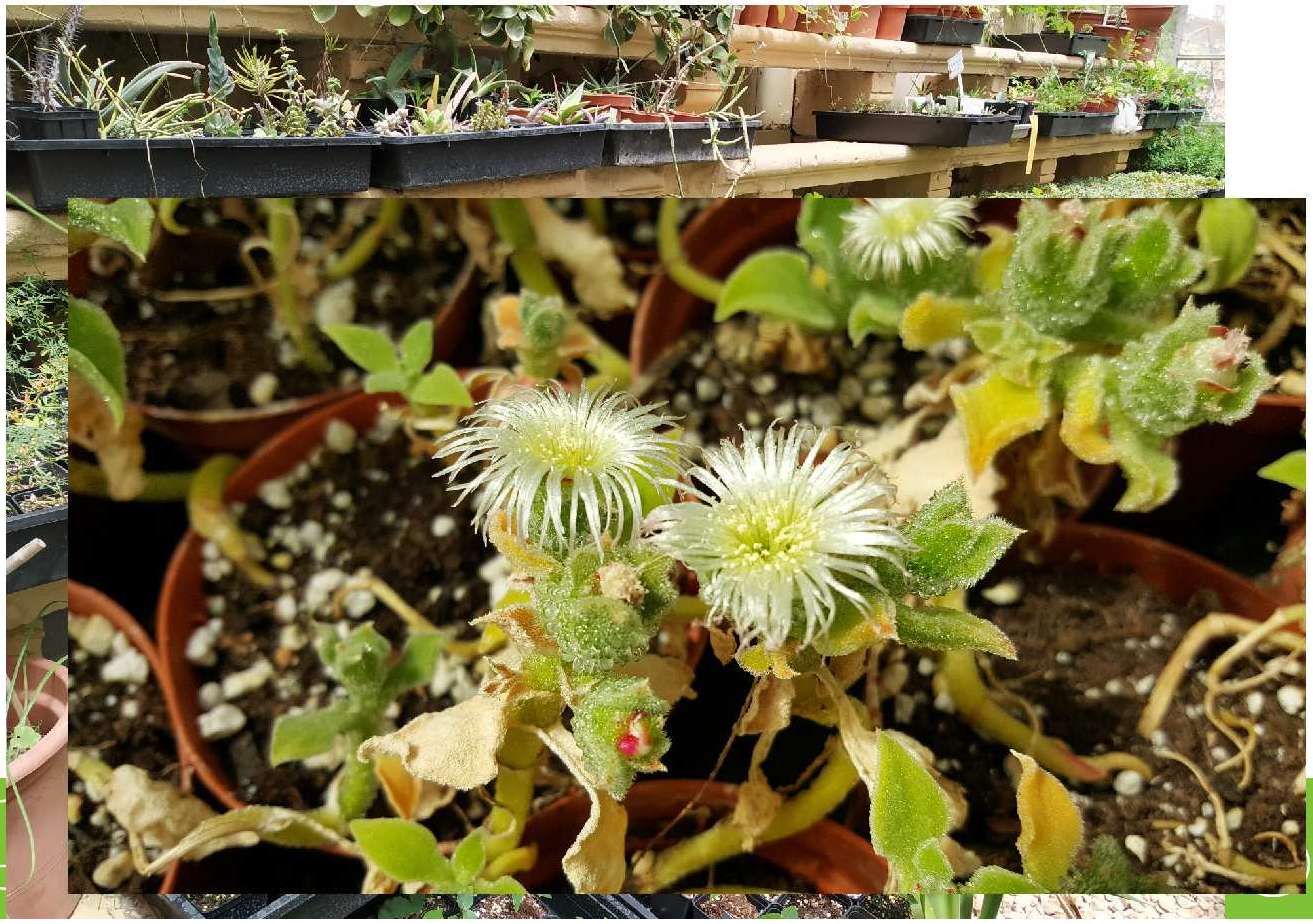
- Understanding ruderal species as r-stategists
- Understanding spread of alien species
- Planning interventions on degraded habitats
- Removal of ruderals – what is the best way and time to do this?
- Removal of alien species – requirement for repeated interventions.

Removal of invasive alien species

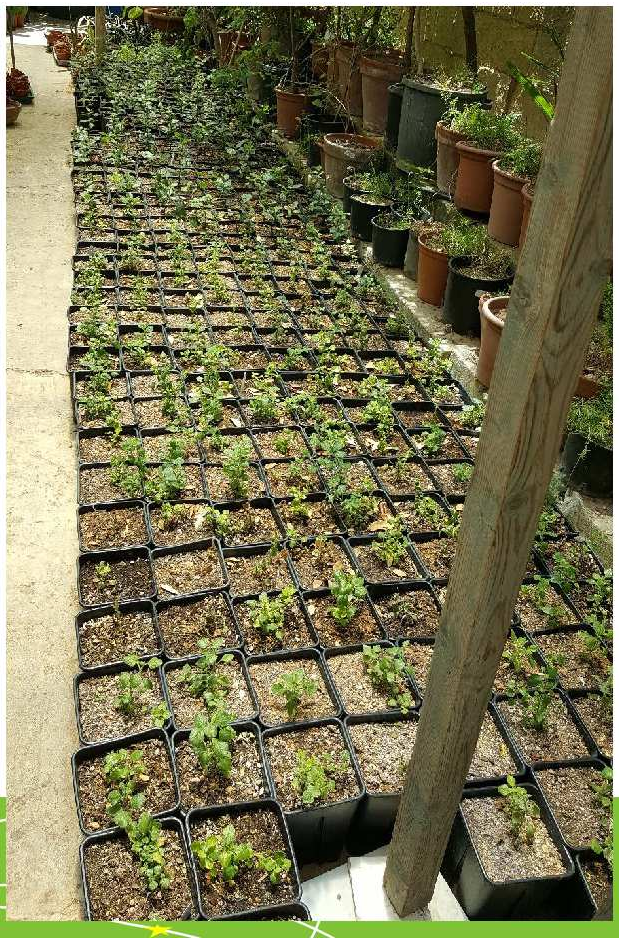
Rehabilitation methods

- Nursery planting: seeding, germination, maturation, transplanting, timing and maintenance.
- Direct Seeding
- Broadcast seeding
- Hydro-seeding
- What followup actions:
  - Intensive maintenance for the first 1-2 years
  - Passive maintenance for subsequent years

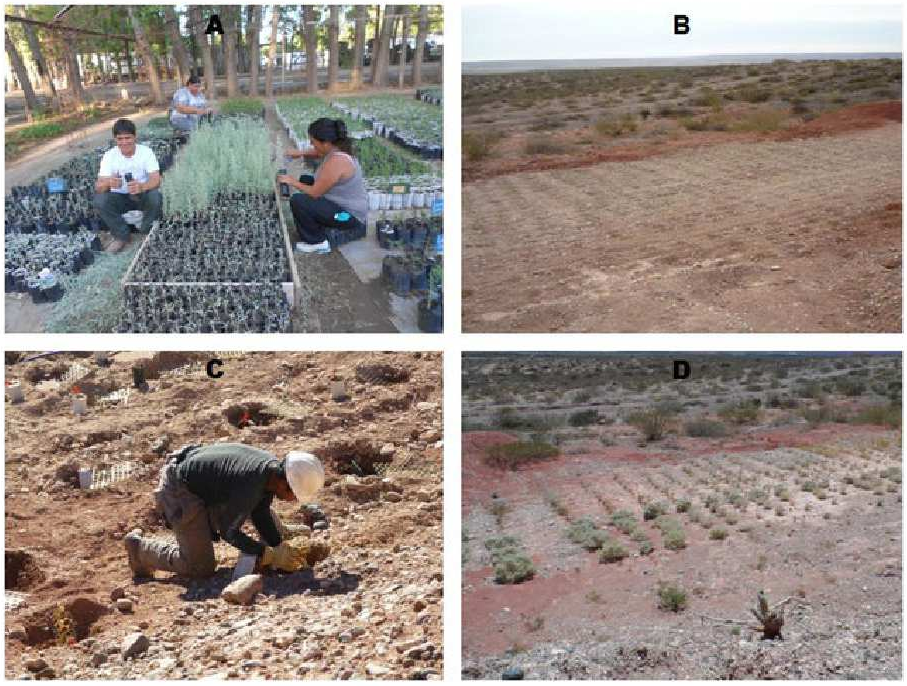
Greenhouse nursery grown plants



Outdoor nursey grown material



From Seedlings to Planting



A) Members of the native drylands species nursery of the ecological restoration cooperative called "**Atriplex lampa**", engaged in plant production tasks; Neuquén, Patagonia Argentina; (B) Before stage of planting in one of the plantation sites; (C) Placement of protection meshes against herbivores during planting; (D) View at 22 months after plantation. Photo credits: A) Florencia del Mar González; B) and C) Daniel R. Pérez; D) Fernando Farinaccio.

https://www.researchgate.net/publication/327582848_Towards_a_dryland_framework_species_approach_Research_in_progress_in_the_Monte_Austral_of_Argentina

Steps to implement direct seeding

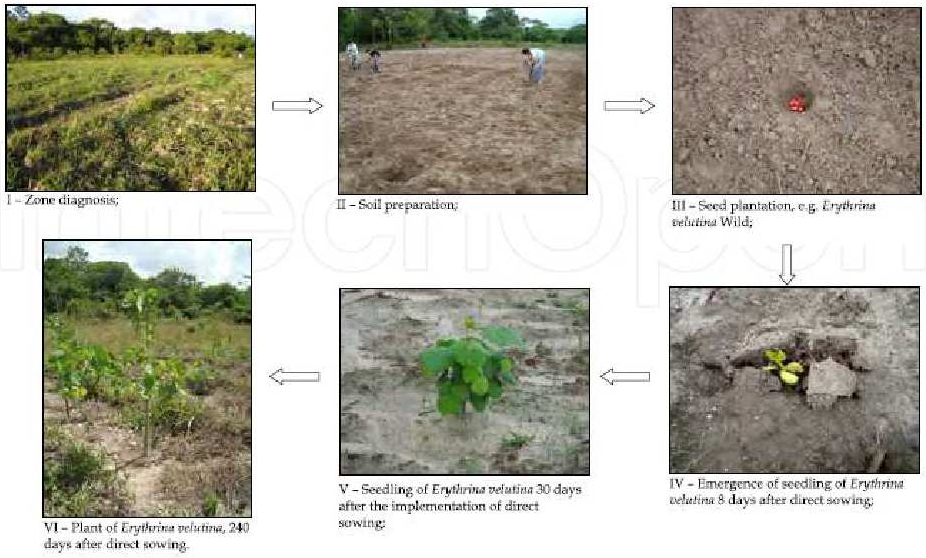
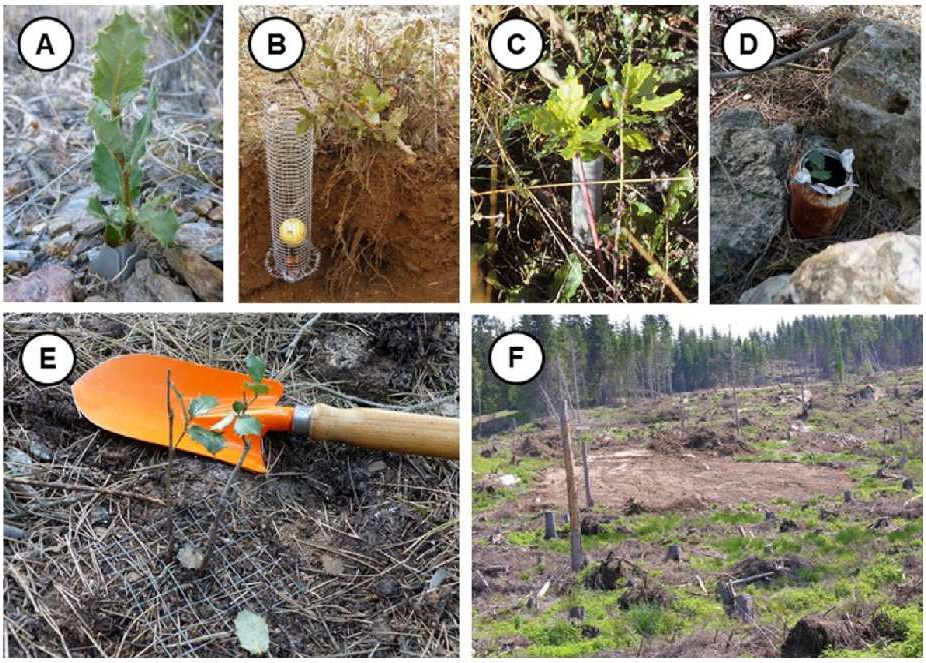


Fig. 1. Illustration of steps required for the implementation of direct sowing in the process of restoration of degraded and riparian zones (Pictures of Santos, 2010).

Steps may include seed pretreatment prior to direct sowing

Restoration & direct seeding



Various devices and techniques for protecting sown acorns from depredation by granivorous rodents at forest restoration sites. These include a seed shelter from which a Q. ilex seedling emerged (A), a wire mesh cylinder used to protect a Q. ilex seedling (B), small degradable tube from which a Q. robur seedling emerged (C), a perforated beverage can and Q. ilex seedling (D), a square wire mesh screen from below which a Q. ilex seedling emerged—note the multiple sprouts and browsing damage on the sprouts (E), and mechanical site preparation to expose mineral soil on a ca 0.33 ha plot) (F). Photo A by A. Leverkus; B, D and E by J. Reque; and C and F by M. Löf. Less

Hydroseeding on steep slopes to control storm water erosion

Problems and hazards associated with transplanting methods

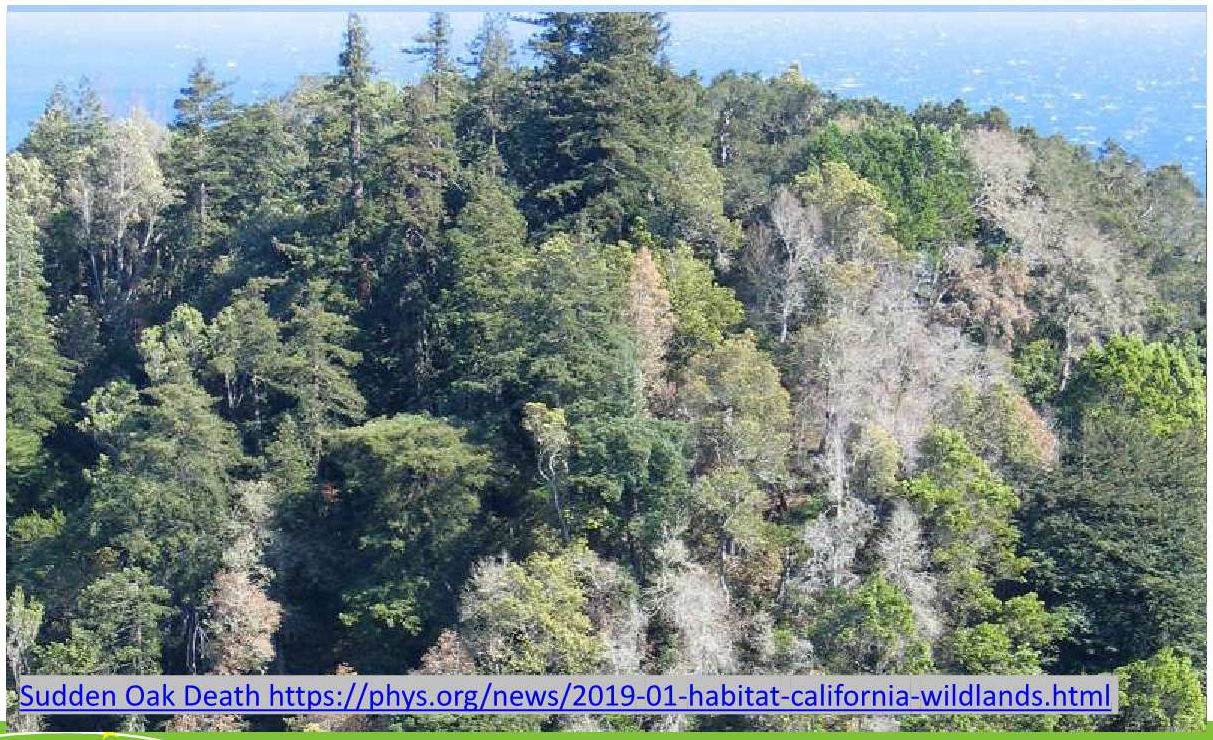
Main problems are:

- Permanent records of artificiality of resulting from planting interventions.
- Man-made interventions can rarely replicate the natural community structure, species diversity and successional stages.
- Overcrowding & takeover by a few dominant species.
- Introduction of pathogens from nurseries – introduction of Fusarium spp. & Phytopthora cinnamomi.

Permanent records of human interventions

https://www.stormh2o.com/erosion-control/vegetation-management/article/13006727/hydroseed-challenges-hydroseed-solutions

Is habitat restoration actually killing plants in the California wildlands?



Sudden Oak Death https://phys.org/news/2019-01-habitat-california-wildlands.html

Spread of nursery borne plant pathogens such as *Phytophthora tentaculate and Phytophthora cinnamomic* leading to mass killing of native plants after planting intervention

Additional Problems

- Logistics for planting.
- Funds for continued maintenance.
- Trained personnel.
- Unpredictable events – climate, fire, vandalism, anthropogenic disturbances.
- Pests and diseases.

Planning a Site Intervention

- Site selection
- Identifying site characteristics – existing vegetation cover or cover on adjacent sites, soil depth, aspect, exposure to wind.
- Identifying the problems.
- Preparing for site interventions eg removal of aliens and ruderals.
- Timing of interventions – when is it best to do this?

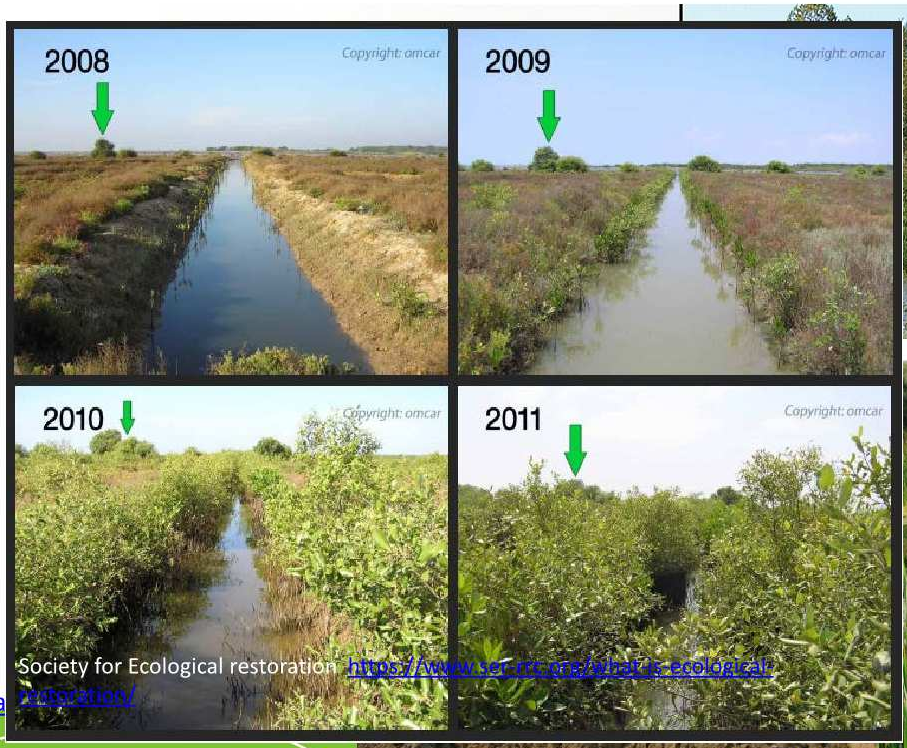
Sites lending themselves to intervention

Deciding on method of intervention

- Planting of Seedlings or broadcast seeding?
- Species selection – go for species diversity or emphasis on founder species.
- Single or repeated seeding to replicate natural phases of succession
- Soil amendments?

Examples of Site interventions

Monitoring progressive changes after site interventions



Society for Ecological restoration https://www.ser-rrc.org/what-is-ecological-restoration/

Wetland restoration https://www.britannica.com/science/ecological-restoration

Importance of educating people

Nature’s hidden rewards…….. transformations

.... and diversity

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Thank You

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