

Innovations in direct seeding : new Spanish techniques in forest landscape restoration

by Francisco MARTINEZ SANZ & Enrique ENCISO ENCINAS

More than one million trees planted in one day... every day

During the 5th Mediterranean Forest Week held in Agadir (Morocco) in March 2017, the High Commission for Water and Forests and Fight against Desertification of the Kingdom of Morocco presented an admirable initiative, which it launched, planting more than one and a half million trees in one day.

Throughout the second half of the past century in Spain, more than one hundred thousand hectares were reforested in one year 23 times. This means many months planting millions of trees each day, professionally, on rough terrain, not with volunteers working around the forest tracks. However, reforestation 120,000 hectares in 1997 sounds much less impressive than planting a million trees in one day.

The way in which we communicate is paramount.

Large scale works, different scenarios

The 5.2 million hectares restored in Spain, starting at the end of the 19th century and made possible thanks to public funding (PEMÁN, J. 2016. University of Lleida), plus those undertaken with private funding, increased the Spanish woodland area to its current 18.4 million hectares. Thanks to these efforts Spain is the country in the EU with the third-largest area covered by trees, after Sweden and Finland. Many Spaniards would be really surprised if they read this, since many do not think that there are many forests in Spain. This is mainly because we usually confuse green lands with woodlands.

So far, we have been speaking about past actions. But the reality is that nowadays Forest Engineers must face different difficul-

ties regarding the changes in society's demands. Nowadays people do not like to see heavy machinery in forests, they do not like to see the land worked in contours, nor do they like plants to have a perfect geometric distribution. We are not saying we are against machines in our field or so on, but we, the technicians, must work to provide the right solution to society's demands.

In addition, we must face the current financial situation in Spain and other Mediterranean countries.

Implementing seedings vs. plantations

At SYLVESTRIS, we strive daily to integrate people and Nature and fill the world with trees. We decided to leverage our expertise in seeds to implement direct seeding instead of traditional plantations, because of the social benefits. A positive Triple bottom-effect:

- Environmental, because we do not rip the land or use heavy machinery;
- Social: by using seeds instead of plants, we can hire people that do not usually work in the field, like women, very young or older people, because it is not necessary to dig holes in hard soil and carry heavy containers with plants;
- And Economic, because seeds are cheaper than seedlings.

Succeeding in reforestation via direct seeding it is not so easy as it may seem. Therefore, we have researched and innovated in order to implement successful direct seeding landscape restoration.

Preparation of the seeds

Based on our experience, preparing the seeds correctly can save 67% of the seeds required. Treatments like priming boost germination and reduce ground exposure time.

Pictures 1 & 2:

Two different images of a hillside in Guadalajara, Spain, restored using *Pinus pinaster* seeds with a priming treatment. The second one (lower) is six years after seedling.
© F. Martínez Sanz.



Developing of specific tools

The SYLVESTRIS Seeder is a specialty tool used to work more efficiently and comfortably. It is a large T-shaped tool which has a circular base with six upturned teeth that surround the central tube, which ends in a beveled cut. It works by supporting the base on the ground, inserting the teeth and the end of the central tube and making an alternate rotation movement with the handles, made by the horizontal tube. The teeth make a superficial scrape on the ground, while the lower part of the central tube is inserted in the center. Then 2-3 seeds are taken from a bag and introduced into the top of the vertical tube. Then the seeder must be raised, while raising and lowering the inner bar, which ends in a spear tip, to avoid soil and / or seed blockages at the end of the seeder. Finally, all we need is to compact the soil with our boot and onto the next spot. None of the tasks described require workers to bend down at any time. The seeds are buried approximately 1.5 to 2 times their diameter.

By using the SYLVESTRIS Seeder, the quantity seeds required can be reduced by 80%, compared to broadcast seeding, which allows increased investment in labor instead of so many seeds.

Use of special protection

We also use the Seed Shelter®, a device developed by the University of Granada (Spain) to individually protect seeds like acorns from rodents.

In our experience, the use of Seed Shelters increases the success in seeding acorns, by almost four times compared to that of unprotected seeds.

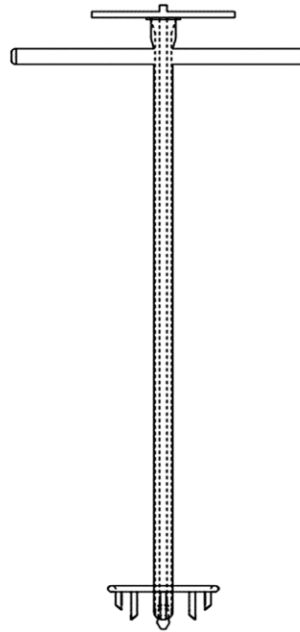
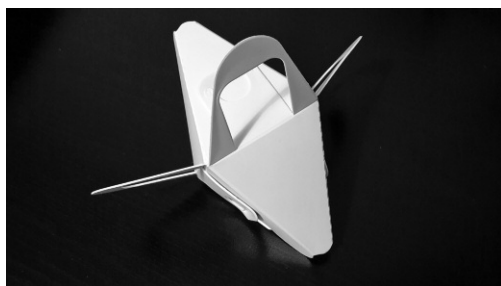
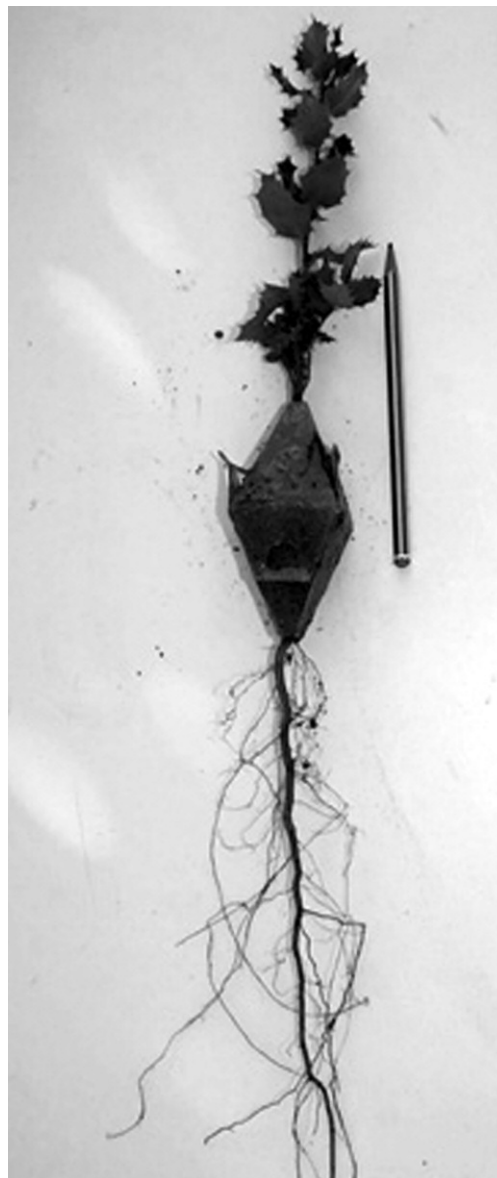


Fig. 1:
SYLVESTRIS seeder
design, Pinus model.



Pictures 3 & 4:
Left, an assembled seed
shelter.
© F. Martinez-Sans.

Right, unearthed seed
shelter with a *Quercus
ilex* seedling.
© J. CASTRO.



Picture 5:
Octocopter seeder
developed by TRIEDRO
and SYLVESTRIS.
© F. Martínez Sanz.

Development of seeding with Unmanned Aerial Vehicles

As far as we have seen, burying the seeds with the SYLVESTRIS Seeder or special protection greatly reduces the number of seeds required. So, what about broadcast seeding? In our opinion, this method is only recommended for aerial seeding, at sites where no other options are possible, such as the octocopter developed by SYLVESTRIS and TRIEDRO, another Spanish company, for seeding areas with extremely steep slopes or which are very isolated.

Conclusions

The main conclusion is that direct seeding, when carried out properly, can save fifty percent of reforestation costs, which is very interesting when facing a poor economy or for increasing the area to be restored.

Properly treating seeds, using the SYLVESTRIS Seeder or Seed Shelters greatly increase the success of seeding. This is not only important in economic terms, as with seedings, the availability of the seeds can be a problem. It is not always possible to obtain hundred kilograms of a specific species of seeds from a specific provenance.

We have also realized that the way we work is truly welcomed. The workers, authorities and managers of protected wilderness areas like direct seedings.

Lastly, there is no magical solution for working with direct seedings; therefore, specific methods must be implemented. We have been researching for twelve years and continue to do so in our lab. So, if someone thinks that adding hot pepper or naphthalene to seeds, or putting them into balls of mud is enough to avoid predation by rodents or wild boars, they will most likely fail. Such failures can harm direct seeding's reputation as an efficient and effective method for forest landscape restoration.

F.M.S., E.E.E.

Summary

On average, forest fires affect more than 500,000 hectares of land every year in the Mediterranean region, 100,000 hectares in Spain alone. Although Spain has monumental experience in forest landscape restoration (5 million hectares restored in approximately 60 years and the majority of them on very difficult sites), this experience does not adequately meet the current needs of society's environmental protection concerns, modern day aesthetics, nor the relevant economic situation. Given this scenario, Grupo SYLVESTRIS, a social entrepreneurship with a mission to fill the world with trees and also known for their design and engineering ingenuity, has decided to implement a "direct seeding" approach versus "plantations" in the restoration of burned areas. Because of the vast benefits of direct seeding (environmental, social and economic), this company has developed innovative tools, protections against predation, new seed treatments and aerial seeding techniques that make the restoration process more efficient and economically viable.

Francisco
MARTINEZ SANZ
Enrique
ENCISO ENCINAS
Forest Engineers and
Founders of Grupo
SYLVESTRIS
A. San Luis 39
28033 Madrid
SPAIN
(+34) 676 40 87 90
www.gruposylvestris.com