



# WEBINAR - Let's Talk About Planted Forests - Robot for silviculture and automatic planting machine

*Automated tree seeding:  
Aerial or Terrestrial?*

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**LAND LIFE**

29 March 2024

*This event is  
co-organized  
by*





# Land Life



75+ team members  
across 5 offices

Netherlands, Spain, North America, Australia, Iceland

50+ clients on 5 continents

across sectors multinational corporations, investors  
and governments

10 years

in nature restoration

End-to-end service

with local partners for maximized impact on climate,  
community and biodiversity

Science-based,  
tech-enabled and field-tested

pioneering restoration at scale for over a decade



## Our impact - Thusfar

2.1m

TONNES OF CO2 TO BE CAPTURED

10m

TREES PLANTED & LIVING

3

CONTINENTS



# Active in 3 continents

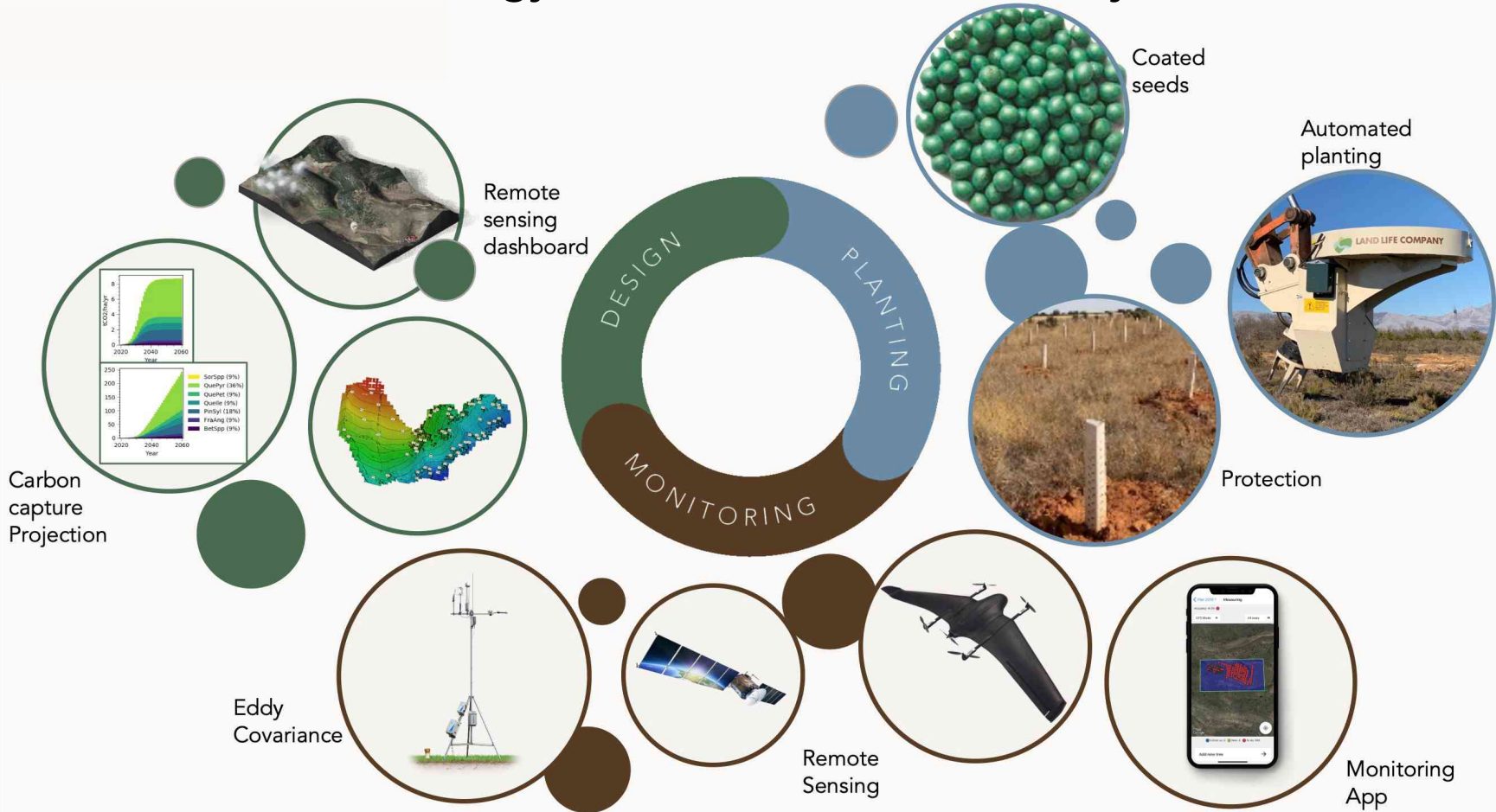


● LARGE-SCALE FOR CARBON SEQUESTRATION

● ICONIC TREE PLANTING FOR WILDLIFE



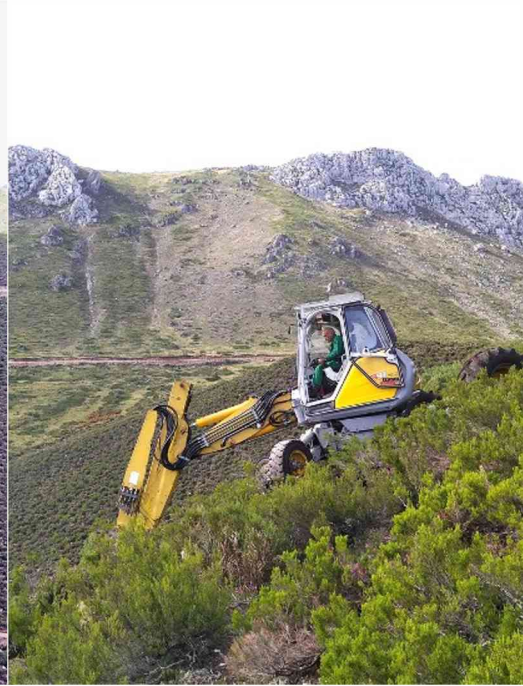
# Science and technology across the reforestation cycle







# Iberia



- Insufficient skilled and dedicated contractors,
- Equipment shortages (excavators/retrospiders),
- Limited nursery capacity and logistics,
- Short & unpredictable planting window,

- Planting material (max. 10-15 species),
- High costs (>Eur 3500 p/ha)
- Not scalable,
- Health and safety risks





# N. America



- Shortages of manual labor for tree raising and planting,
- Limited planting material (species choices)
- Maximum nursery capacity for landscape restoration reached, necessitating direct seeding,
- Rapidly declining sources of seeds (inconclusive results from drone seeding, with often less than 1% germination)



# Australia



- High seeding rate limited to flat to gently undulating terrain without rocks
- High seed use,
- Increasing seed costs,
- Use of 4x4 vehicles with seeders running on fossil fuels, while bulldozers in more challenging terrain cause soil compaction.
- Line seeding has limited biodiversity potential, with canopy closure slowed down especially at wide (10m) spacing,
- Risk of potential gully erosion from off-contour seeding,





# Aerial vs Terrestrial seeding

Main issue		Approach	Aerial seeding	Terrestrial seeding	Land Life objective: reduce seed number & improve <i>site</i> establishment
seed	quality	screening	✓	✓	<ul style="list-style-type: none"> <li>Seed Enhancement               <ul style="list-style-type: none"> <li>Cleaning, upgrading, priming,</li> <li>Additives: predation control, drought stress</li> </ul> </li> </ul>
	predation	coating	✓	✓	
site	drought	water retention	●	✓	<ul style="list-style-type: none"> <li>Selecting high potential macro sites               <ul style="list-style-type: none"> <li>Land Evaluation Tool for digital seed mapping (slopes, aspect, rainfall)</li> <li>Prescription seeding</li> </ul> </li> <li>Micro site enhancement               <ul style="list-style-type: none"> <li>Soil prep / scarification</li> <li>Hydrogels, biochar</li> <li>Protection (a)biotic stresses</li> </ul> </li> </ul>
		water harvest	●	✓	
	nutrition	amendments	●	✓	
	weed	herbicide	●	✓	
		weeding	●	✓	
	browsing	bio-deterrent	●	✓	
shelter		●	✓		

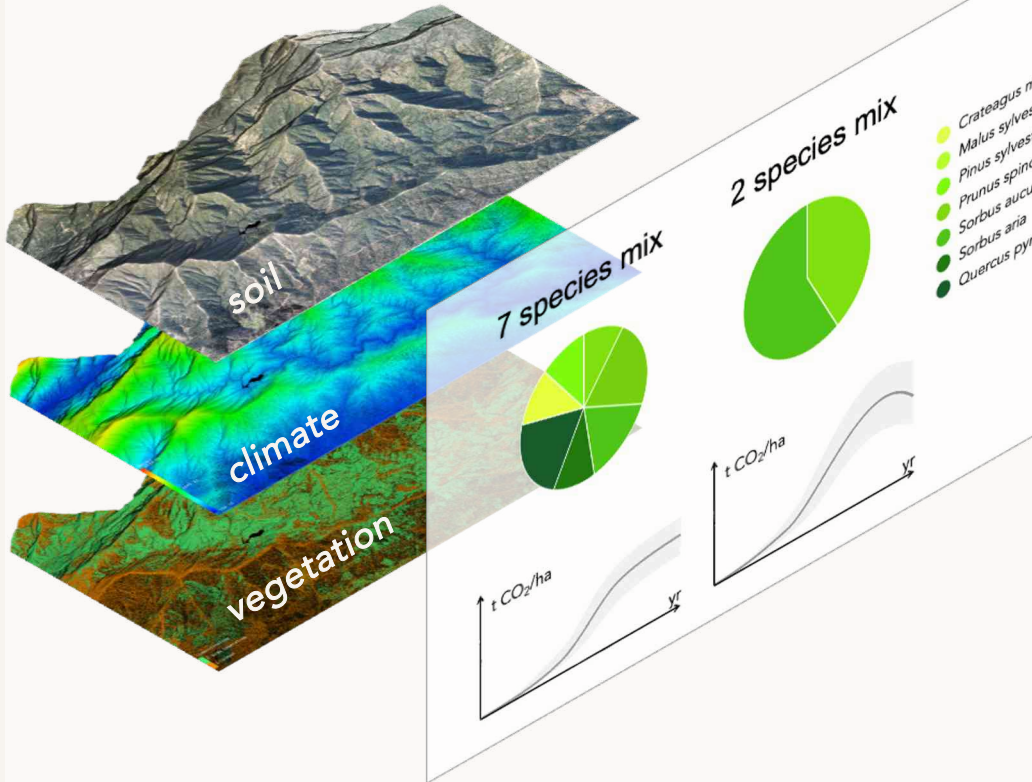


# Prescription seeding

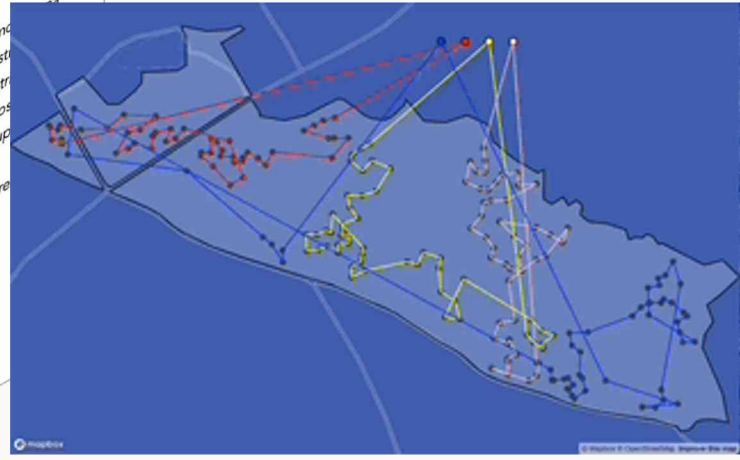
Remote Sensing Dashboard

Fast Track analysis

Prescription seeding map

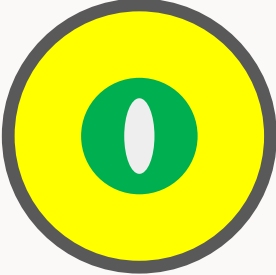
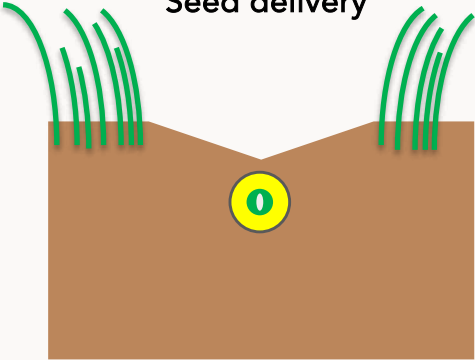


- *Crateagus mo*
- *Malus sylvestr*
- *Pinus sylvestr*
- *Prunus spinos*
- *Sorbus aucup*
- *Sorbus aria*
- *Quercus pyre*





# Terrestrial seeding

	Intervention	Desiccation	Predation
<p><b>Seed enhancement</b></p> 	<ul style="list-style-type: none"> <li>Seed upgrade</li> <li>Priming (bet-hedging)</li>   <li>Water retention</li> <li>Biostimulants</li> <li>Growth regulators</li>   <li>Bio-repellent</li>   <li>Seed handling</li> </ul>	<ul style="list-style-type: none"> <li>•</li> <li>•</li>   <li>•</li> <li>•</li> <li>•</li>   <li>•</li>   <li>•</li> </ul>	<ul style="list-style-type: none"> <li></li> <li>•</li>   <li></li> <li></li> <li></li>   <li>•</li>   <li></li> </ul>
<p><b>Seed delivery</b></p> 	<p><b>Soil prep:</b></p> <ul style="list-style-type: none"> <li>○ Scalping/Weeding</li> <li>○ Subsoiling</li> <li>○ Amendments</li>   <p><b>Seed embedment</b></p> <li>○ Moisture availability</li> <li>○ Predation control</li>   <p><b>Micro-siting</b></p> <li>○ Shrubs, logs</li> <li>○ Shuttle</li> </ul>	<ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li>   <li></li> <li>•</li> <li>•</li>   <li>•</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li>   <li></li> <li>•</li> <li></li>   <li></li> <li>•</li> </ul>





# Terrestrial seeding robot

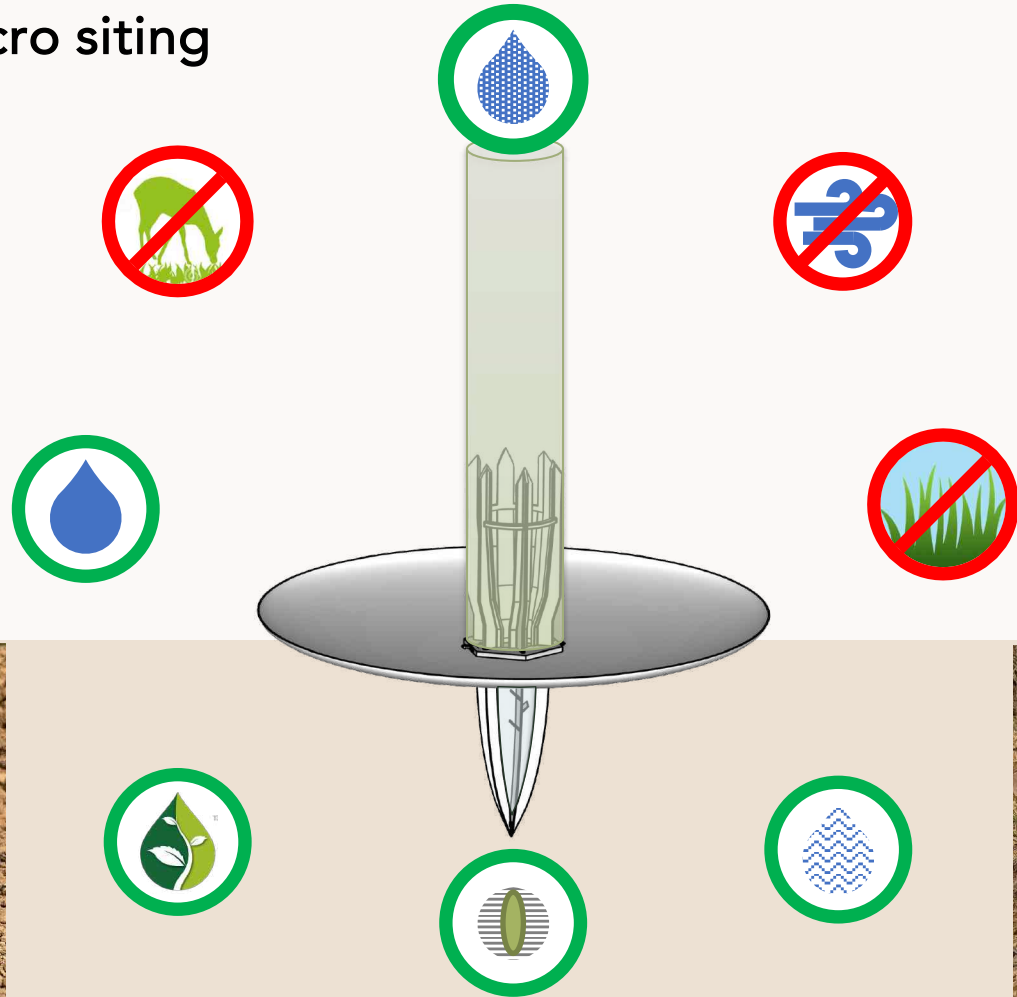
Seeding unit mounted on light weight, electrically powered mini tractor.

- Multiple seed tanks
- Species specific precision seeding
- Soil scalping:
  - long lasting weed control,
  - rain water harvesting in conically shaped nano-catchment
- Subsoiling:
  - deep water infiltration to improve subsurface moisture retention





# Shuttle - micro siting





# Shuttle - micro siting







## Next steps..

- Seed predation
- Autonomous seeding
- Fleet management
- Challenging terrain conditions
  
- Suggestions?