

## A future full of ancient trees

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**IMAGE:** DAVID MILARCH SAYS GETTING THE FRESHEST NEW GROWTH FOR GENETIC SAMPLES REQUIRES GOING TO THE VERY TOPS OF TREES. (SUPPLIED/ARCHANGEL ANCIENT TREE ARCHIVE)

It's no easy task, but after 20 years David Milarch believes he's zeroed in on what it takes to clone a 3,000-year-old tree. **Antony Funnell** reports on the quest to preserve the genetics of the largest and oldest living things on Earth.

If you want to share David Milarch's vision of the future, you'll need commitment, drive and a good set of climbing ropes.

But if you're afraid of heights, well, you might want to think again, because helping David in his mission to save the environment could involve climbing hundreds of feet up a giant sequoia or shimmying along the boughs of a massive gnarled oak.

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**DAVID MILARCH, THE ARCHANGEL ANCIENT TREE ARCHIVE**

ilarch has a passion for trees. Not just any old trees—trees that are really, really, really old, plants so ancient they've outlived empires, a mini-ice age, even whole civilisations.

But his self-declared mission isn't just to observe or preserve, it's to propagate. The plan involves a unique cloning process that Milarch and his colleagues have developed at their research facility in the village of

Copemish in north-east Michigan, a technique that's used to strengthen old growth forests by mapping and replicating their genetic past.

'When we began down this road 20 years ago we were soon told by most universities that it was impossible to clone the world's largest and oldest trees, that it was like asking a 110-year-old woman to bear a child. Forget about it, it won't work, we've tried, you're wasting your time. Well, that is not the case. We've been successful with over 170 different species.'

Milarch's not-for-profit organisation is called the Archangel Ancient Tree Archive, and over the past two decades they've successfully cloned more than 22 of the oldest oak trees in Ireland—trees more than 1,000 years old—as well as more than 70 giant redwoods in the United States; the oldest of which, Milarch likes to point out, was already several hundred years old at the birth of Christ.

'The reason that we are cloning the largest and oldest living things on Earth is to preserve their genetics. We've destroyed 85 per cent of the world's forest before we've even studied them. None of our old growth forest genetics have been studied. There just hasn't been the money for it.'



**IMAGE: GIANT REDWOODS ARE AMONG THE OLDEST LIVING THINGS ON EARTH. (FLICKR.COM/COL FORD AND NATASHA DE VERE/CC BY 2.0)**

Those genetics, Milarch argues, could prove extremely useful in combating the adverse effects of ongoing climate change. If these trees have survived all that humankind and nature has thrown at them, so the argument goes, they must have the sort of resilience needed to cope with future extremes of weather.

'We found a lost grove of giant sequoias in the southern Sierra Nevada mountain range at an elevation of 7,000 feet,' Milarch says.

'They are not supposed to be there. It's too hot, too dry, it never rains there in the summer. The only water they get is from snow melt, but there are 700 acres on top of this mountain of old growth sequoias that are bigger in

diameter, taller and healthier than any known giant sequoias on Earth. That's the type of forest of trees that we are looking for: not just the oldest trees on Earth but the largest, the healthiest, the best of the best.'

Cloning ancient trees is no easy task. 'It's tricky. Real, real tricky,' Milarch concedes. 'We failed a lot in the beginning before we started zeroing in on what it would take to have a 3,000-year-old tree allow us to clone it.'

'We went to the very tops of the trees and out to the end of the branches and got this year's new growth, the greenest, freshest new growth, where those compounds and those hormones hadn't reached that genetic material of the plant. But climbing 380-foot trees is risky business.'

Once the collection process has been completed, the genetic material gathered by the climbers is put through a micro-propagation process at the archive's warehouse facility in Copemish, and eventually thousands of saplings are made ready for planting.

'What we recommend and what we have done when we have rebuilt a redwood old-growth forest is ... you use 100 seedlings for every cloned tree that you replant those forests with. So genetic diversity is guaranteed by using seedlings which are only 50 per cent of the genetics of the parent, and at the very minimum 10 seedlings for every clone.'



**IMAGE: GENETIC MATERIAL IS PUT THROUGH A MICRO-PROPAGATION PROCESS BEFORE THOUSANDS OF SAPLINGS ARE MADE READY FOR PLANTING. (SUPPLIED/ARCHANGEL ANCIENT TREE ARCHIVE)**

While unique in its focus and approach, the Archangel Ancient Tree Archive isn't alone in its emphasis on the urgent need to safeguard plant genes.

From its base in the UK, a global initiative called the Millennium Seed Bank now helps coordinate the collection and preservation of seed stocks across the world. The organisation's conservation and partnership coordinator Tim Pearce says the bank's selection process is based on what he calls the 'three Es'.

'Are they endangered? If they are endangered then somebody has got to look after them. Are they endemic to a particular area? Basically, do they only occur in a very, very small area and are they therefore susceptible to change in land use? That's the second E,' he says.

'And the third E is are they somehow economically important? There's a whole plethora of information out there about how plants are used by local communities, by industry or needed by research for particular aspects of our scientific community.'

**Read more: [Tapping gene banks to secure our food future](#)**

Through its international partnership program, the bank is currently working with national and independent seed collection agencies in more than 132 countries, preserving valuable seed stocks for the future, but also making them available for replanting when requested by participating agencies.

Echoing the sentiments of David Milarch, Pearce says the process has been as much about gathering new genetic insights as it has been about preservation.

'There is a growing recognition that as we collect, as we build our collection of seeds across these 350,000, 400,000 plant species on the planet, we are slowly building up our understanding of how to manage plant biodiversity,' he says.

'If we know how to manage the seeds of these plants then we know how to better keep them alive, giving people options for security in the future.'



**IMAGE: A SCIENTIST HOLDS A JAR OF SEEDS IN THE MILLENNIUM SEED BANK STORAGE VAULT. (SUPPLIED/RBG KEW)**

Such options may be needed sooner rather than later according to the latest research around the impact of climate change on Australian plants and seeds. Recent studies conducted in Western Australia have identified a mature tree die-off rate of up to 25 per cent in some areas affected by recent extreme drought conditions. The associated

affect on seed germination has also been troubling, according to Professor Don Driscoll from the Ecological Society of Australia.

'One of the impacts of climate change is heating the soil, and that's affecting the soil seed banks, so high temperatures can kill seeds in the soil, meaning there are going to be less plants germinating when the conditions are right,' he says.

'But the other thing that heating of the soil does is it can break the dormancy of some of the seeds, and that can cause plants to germinate at the wrong time when the seedlings have no hope of survival.'

Part of the solution, Driscoll says, is to be far more selective about where trees are replanted and what varieties of seeds will work best in specific areas.

'As the climate changes we are going to need to use our seed banks to establish populations in new areas where the climate is more suitable for those species now,' he says.

'An important strategy for keeping a lot of our plant species is going to be to shift where we plant them. Seed banks are already a major tool in conserving our plant species, and their role is really going to grow as climate change becomes more severe.'

In rural Michigan, tree cloner David Milarch continues to draw his hope for the future from the power of the past. The success of his cloning and replanting program in North America and Ireland is now set to be replicated in other parts of the world. The Archangel Ancient Tree Archive is just about to begin a new cloning project targeting the oldest and largest trees in the United Kingdom. And there are plans to establish additional propagation facilities on the west coast of the United States and in the UK.

Milarch is also working to finalise a global priority list of the top 100 tree species deemed essential for cloning. Exactly the sorts of ancient trees, Milarch says, that will be needed in order to 'anchor the ability for humans to live on the planet'.

**Source: <http://www.abc.net.au/radionational/programs/futuretense/a-future-full-of-ancient-trees/7134110>**