



# Practice Case Study: Assisted Migration of Rust-Resistant Whitebark Pine

## Description

A case study from the course on [Genomics, Ethics, and Society](#). This case looks at different policies to protect the endangered whitebark pine.

## Body

The whitebark pine (*Pinus albicaulis*) is a widespread species of subalpine and treeline habitats in western North America, and an iconic tree of the American mountain West. It is often considered a keystone species, because its seeds are an important food source for montane species, including overwintering grizzly bears; it regulates runoff by inhibiting snowmelt; and, as a 'foundation' species, it can create the conditions for other plant species to germinate and grow at high elevations (Fish and Wildlife Service, 2011). The whitebark pine has very large, wingless seeds, and depends on a specialized mutualist relationship with a bird, the Clark's Nutcracker (*Nucifraga columbiana*), for dispersal. The birds extract whitebark pine seeds from cones, transport them, and then cache them for later consumption (Hutchins and Lanner, 1982; Tomback, 1982). Usually, new whitebark pines only grow from these nutcracker caches.

Over the past few decades, numbers of whitebark pines have plummeted: more than fifty per cent of trees are deceased or dying (McLane and Aitken, 2012). The major cause of this decline is white pine blister rust (WPBR), caused by an invasive fungal pathogen. A second threat to whitebark pine is increasing mortality from mountain pine beetles, which prefer trees weakened by WPBR. These threats combined have

reduced cone production, which in turn has undermined dispersal by nutcrackers, who switch to other (less preferred) food sources below a certain level of cone production. But the greatest threat in the long term is climate change. As the climate warms, it's likely that beetle attacks will intensify, and the climate envelope in which whitebark pines can survive will shift northward. Whitebark pine is currently predicted to lose at least 97% of its climatic niche in the United States by 2055 (McLain and Aitken 2012).

Several possible strategies for protecting the whitebark pine have been proposed. At the less radical end, these include felling competitor tree species. Another possibility, currently being trialed, is to select and propagate genetic strains of whitebark pine that are relatively resistant to white pine blister rust. But since whitebark pine take about 60 years to reach reproductive maturity, by the time any rust-resistant trees have become mature, the climate may no longer be suitable for them in most of their current range.

This has led to suggestions that the rust-resistant whitebark pine should be deliberately moved (a process called "assisted migration") further north, into areas in Canada where it could grow now, and that are likely to remain suitable in climatic terms for the foreseeable future. However, assisted migration of the whitebark pine raises significant logistical questions. Most pressingly, in order for the trees to successfully reproduce in their new location, Clark's Nutcrackers would have to be moved too. Alongside the logistical questions, there are also significant social, cultural and ecological values at stake. Moving the pine will protect some values, but it will fail to preserve others, and may threaten yet others. But if the whitebark pine is not moved, the likelihood is that it will go extinct.

- Imagine that you are in charge of making a decision about whether or not to move rust-resistant whitebark pine.
  1. Consider the social, cultural and ecological values that may be at stake, and the positions different stakeholders may take on this issue (both in terms of the selection of strains of relatively rust-resistant trees, and their relocation). What would your recommendation be?
  2. Should rust-resistant whitebark pine be moved to new locations in Canada?

## References

- Fish and Wildlife Service. 2011. 'Endangered and threatened wildlife and plants: 12-month finding on a petition to list *Pinus albicaulis* as endangered or threatened with critical habitat'. Online at <http://gpo.gov/fdsys/pkg/FR-2011-07-19/pdf/2011-17943.pdf> (accessed 10 August 2014).
- Hutchins and Lanner, 1982. 'The central role of Clark's Nutcracker in the dispersal and establishment of whitebark pine'. *Oecologia* 55: 192-201.
- McLane, S. and S. Aitken. 2012. 'Whitebark pine (*Pinus albicaulis*) assisted migration potential: testing establishment north of the species range'. *Ecological Applications* 22: 142-153.
- Tomback, 1982 'Dispersal of whitebark pine seeds by Clark's Nutcracker: a mutualism hypothesis'. *Journal of Animal Ecology* 51: 451-467.

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