

# Birnam Woods, Moving Closer, Shadows Our Work

Steven N. Handel

The impossibility of a forest that could move served to quiet fears of the future for a troubled king:

Apparition:

*Macbeth shall never vanquish'd be until  
Great Birnam wood to high Dunsinane hill  
Shall come against him.*

Macbeth responds:

*That will never be  
Who can impress the forest, bid the tree  
Unfix his earth-bound root?*

(Macbeth, Act 4, scene 1)

Then, in one of the play's most vivid scenes, it happened. Soldiers masked by tree boughs marched through Scotland towards the king, and his terrifying fate, once impossible to imagine, unfolds.

We now move from ancient literature to the feckless present, from the playwright's imagination to our reality of escalating climate change and its biotic consequences. With the globe warming, the distributions of land and sea species may move, as each entity's spatial niche changes location (or disappears). There is a dynamic relationship between the removal of the appropriate climatic envelope for a species and its ability to move to a place where the migrating favorable climate can be found. Movement of diaspores depends on wind, water currents, or mutualists, and for plants, speed of movement may not match the rate of loss of favorable locations. The speed of movement is also slowed for most species by the physical barriers that people have added to the landscape. Roads, tall buildings, agricultural and sports fields all can slow movement of diaspores and the consequent establishment of new populations. Climate continues to change potential vegetation zones, but seed carriers may not keep pace. Loss of range results.

Many surveys have shown that trees, insects, and other taxa have already moved beyond their historic zones because of climate change. Public agencies have cataloged

the expected loss of even common species from their current range. This will have severe economic and social consequences as well as habitat structure effects. The change in vegetation zones that is occurring corresponds in our time to the moving woods that Shakespeare fancifully created in his *Macbeth*. Art has become reality.

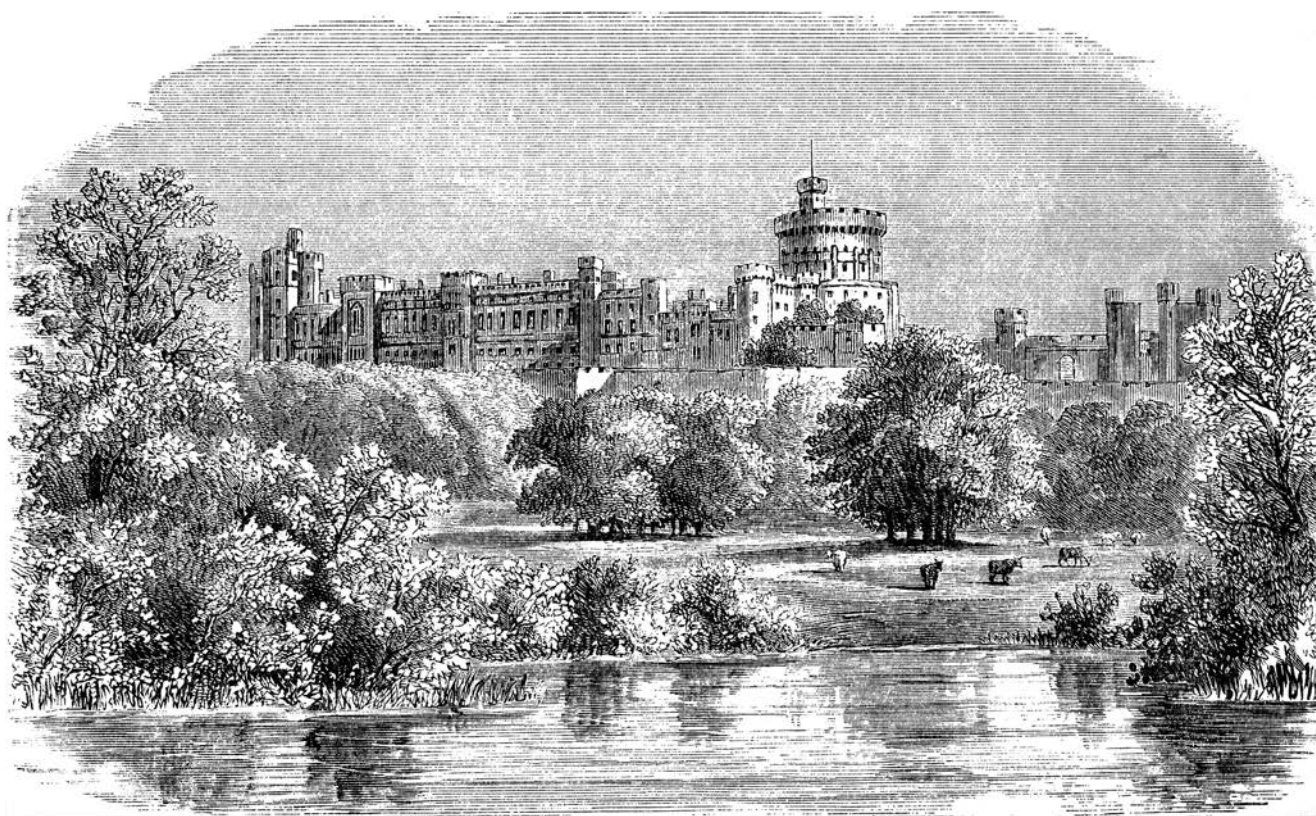
The natural movement of woodlands is not an effective solution to our climate transition, as community members move at different rates and the functioning of the displaced habitat elements is challenged by a probable loss of associated species necessary for sustainability. We rarely know the full membership of a mature community necessary for function. For example, the increasing awareness of the role of microbial species in community ecology function has added to the problem. Restoration ecologists could act to reintroduce necessary mutualists that have tarried behind the plant species we are interested in securing, but this plan assumes a depth of knowledge about interspecific associations that is simply not available.

This "assisted migration" of species seems helpful as an act of ecosystem kindness, but ecological damage by human-led movement of species has a terrible track record, even leading to ecosystem destruction, and is discouraged by many careful workers that have studied plant and animal migrations and introductions. We are left with an insecurity about proper restoration action to parry the movement of habitats as the local climate shifts. Do we stand aside and let species move at their own pace, knowing that long-established species associations are being broken? Do we build social and financial assets to move certain species to new geographies, knowing the real dangers that such actions have caused in the recent past?

The unfolding environmental realities that frame our restoration ecology work must be confronted. It is difficult enough to succeed is restoring habitats in local, rather static, settings. The changes in species distributions that have already been recorded present us with even more uncertainly. Our contemporary analog of Birnam Wood "unfixing earth-bound root" is real, not creative literature. The playwright's ending was death to the protagonist. What restoration actions can save the moving woods? Does the intelligent action appear like inaction?

## Recommended Readings

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