From Forest Nursery Notes Winter 2013

100. © Assisted migration: introduction to a multifaceted concept. Ste-Marie, C., Nelson, E. A., Dabros, A., and Bonneau, M.-E. Forestry Chronicle 87(6):724-730. 2011.

Assisted migration: Introduction to a multifaceted concept

by Catherine Ste-Marie[1], Elizabeth A. Nelson[1], Anna Dabros[1] and Marie-Eve Bonneau[1]

ABSTRACT

The idea that humans can assist nature by purposely moving species to suitable habitats to fill the gap between their migration capability and the expected rate of climate change is being increasingly contemplated and debated as an adaptive management option. The interest in assisted migration, both in the scientific community and society at large, is growing rapidly and is starting to be translated into action in Canada. However, the concept is in its infancy; clear terminology has not yet been established and assisted migration still encompasses a broad range of practices. This introductory paper for the special issue of *The Forestry Chronicle* on the subject of assisted migration describes increasing interest in the subject and its complexity. It also provides an overview of the potential scale of assisted migration, proposes a terminology, and briefly introduces the following papers. Overall, the five papers aim to present a comprehensive state of the scientific and operational knowledge and the debate on assisted migration in the context of Canada's forests.

Key words: assisted migration, Canada's forests, climate change, forest management, adaptation, species migration

RÉSUMÉ

L'idée que les humains peuvent aider la nature en déplaçant volontairement des espèces vers les habitats qui leur conviennent dans le but de réduire l'écart entre leur capacité de migration et la vitesse des changements climatiques est de plus en plus prise en considération et débattue comme option d'aménagement forestier adaptatif. L'intérêt pour la migration assistée, tant dans la communauté scientifique que dans le public en général, augmente rapidement et a commencé à se traduire en action concrètes à travers le Canada. Cependant, le concept de migration assistée est nouveau, la terminologie qui lui est associée n'a toujours pas été arrêtée et le terme migration assistée désigne une grande diversité de pratiques. Cet article d'introduction au présent numéro spécial de *The Forestry Chronicle* sur le sujet de la migration assistée décrit l'accroissement de l'intérêt pour cette pratique ainsi que sa complexité. De plus, il présente un survol de la diversité d'échelle d'application potentielle de la migration assistée, propose une terminologie et introduit les autres articles. Dans son ensemble, ce numéro spécial a pour but de présenter une couverture exhaustive du sujet en proposant l'état des connaissances scientifiques et opérationnelles, ainsi que l'état du débat sur la migration assistée dans le contexte des forêts du Canada.

Mots clés : migration assistée, forêt du Canada, changements climatiques, aménagement forestier, adaptation, migration des espèces

The Context

Changes in climate have accompanied the development of life on earth, but the rate of current climatic changes is unprecedented and projected to increase (IPCC 2007). General Circulation Models (GCMs) predict that an average temperature increase in North America could be between 2°C and 5°C (IPCC 2007). Warming is especially pronounced at northern latitudes, where increases up to 10°C in winter temperatures are projected by 2100 (IPCC 2007). The impacts of the changing climate are already being observed in Canada's forests, and are evidenced by the increase in the frequency and severity of natural disturbances such as wildfires, pest outbreaks and droughts (Lemprière *et al.* 2008, Williamson *et al.* 2009, Michaelian *et al.* 2011). Observations of more subtle impacts such as changes in the phenology (Arft *et al.* 1999, Menzel and Fabian 1999, Ahas *et al.* 2002, Parmesan and Yohe 2003, Walker *et al.* 2006) and the ranges of species (Gamache and Payette 2005, Caccianiga and Payette 2006, Hickling *et al.* 2006, Parmesan 2007, Beckage *et al.* 2008, Lenoir *et al.* 2008) are also accumulating and can be attributed to climate change with increasing confidence (Parmesan 2006, Rosenzweig *et al.* 2008).

Even though species are migrating toward higher latitudes and altitudes to follow their climatic niche in space, the rate of climate change is estimated to generally exceed the potential migration speed of species (Malcolm *et al.* 2002, Jump and Peñuelas 2005, Aitken *et al.* 2008). The immobility of individual plants makes them especially vulnerable to climate maladaptation, and this is often more pronounced for tree species because their long generation time may limit rapid adaptation (Vitt *et al.* 2010). Based on atmosphere–ocean GCMs, McKenney *et al.* (2007) estimated that climatic envelopes for major North American tree species could shift 330 to 700 km northward over the next half-century (6600 to 14 000 metres per year). Rates of northward tree migration after the last glacial maximum in Europe and North America, estimated from fossil pollen data, range between 100 and 2000 metres per year (Davis 1981, Huntley and Birks 1983, Pakeman 2001). In the eastern United States, the migration potential of five tree species, persimmon (*Diospyros virgini-*

[1]Natural Resources Canada, Canadian Forest Service, 580 Booth St., Ottawa, Ontario K1A 0E4. E-mail: catherine.ste-marie@nrcan-rncan.gc.ca, elizabeth.nelson@nrcan-rncan.gc.ca, anna.dabros@nrcan-rncan.gc.ca, marie-eve.bonneau@nrcan-rncan.gc.ca