Altitudinal seed dispersal by mammals under global warming

Shoji NAOE (Tohoku Research Center, FFPRI, JAPAN)
Email: shojinaoe@affrc.go.jp, HP: https://researchmap.jp/shojinaoe?lang=en

Introduction

Background: Tree migration under global warming

- Under global warming, trees need to migrate toward colder areas (i.e., higher latitude or altitude) by seed dispersal.
- Altitudinal seed dispersal has not been evaluated due to technical difficulties.

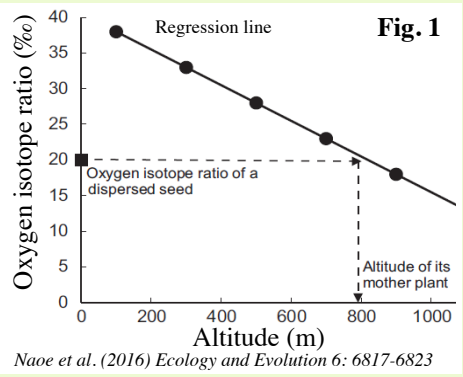
➡ It makes difficult to predict how the distribution of tree species and forests will change under global warming.

Study aim: To Evaluate altitudinal seed dispersal by temperate mammals using the oxygen isotope ratio of seeds in the Kanto mountains of Japan

How to estimate altitudinal seed dispersal

There is a negative correlation between altitude and the oxygen isotope ratio of "non-dispersed" seeds (**Fig.1**, regression line). Thus we can identify the altitude of the mother plant of "dispersed" seeds by using this correlation and the oxygen isotope ratio of dispersed seeds.
Finally,

Altitude of dispersed seed
— Altitude of mother plant
= Altitudinal seed dispersal distance



Naoe et al. (2016) Ecology and Evolution 6: 6817-6823

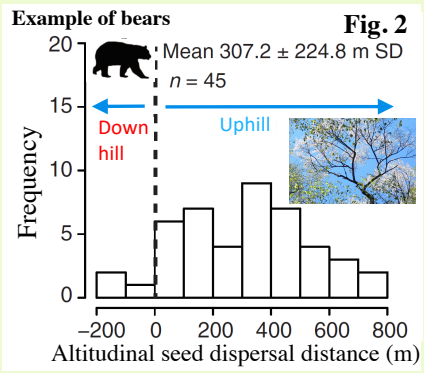
Targets: fleshy-fruited plants

- More than 1/3 of all plants.
- Birds and mammals are the major seed dispersers.
- Animal behavior determines the seed dispersal pattern.

➡ Difficult to predict the pattern.

The results so far

*Result 1: **Summer**-fruiting wild cherry*

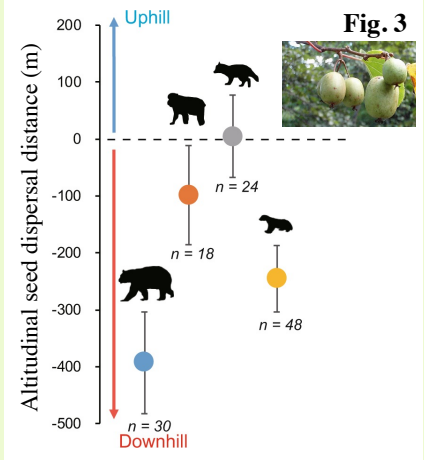


Mammals (bears and martens) dispersed seeds of summer-fruiting wild cherry toward **higher and colder** altitudes (**Fig.2**).

Migration success under global warming!

Naoe et al. (2016) Current Biology 26: R315-R316

*Result 2: **Autumn**-fruiting wild kiwi*



All mammals (bears, macaques, and martens) except raccoon dogs dispersed seeds of autumn-fruiting wild kiwi toward **lower and warmer** altitudes (**Fig.3**).

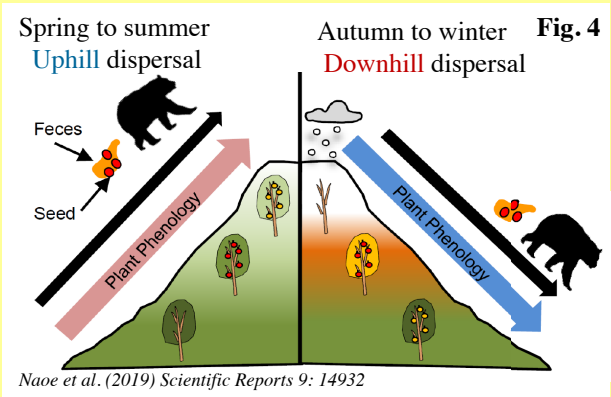
Migration failure under global warming?

Naoe et al. (2019) Scientific Reports 9: 14932

Discussion and perspective

In the temperate zone, plant phenology starts from the base of mountains and proceeds upward in spring to summer, and reverses in autumn to winter (**Fig. 4**).

➡ Mammals would move following the phenology of their foods plants, resulting in uphill seed dispersal in summer and downhill seed dispersal in autumn.



Naoe et al. (2019) Scientific Reports 9: 14932

Considering that many fleshy-fruited plants fruit in autumn to winter in the temperate zone, they may not be able to "escape" from global warming effectively.
However...

- How about seed dispersal by bird?
- How about nut plants such as oaks and beeches?
- How about recruitment after altitudinal seed dispersal?

—Now we are studying these topics! If you have any questions or comments, please contact me.

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