Elevation mechanism of timberline ecotone on the southern slope of Mt.Fuji

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What`s Mt. Fuji?

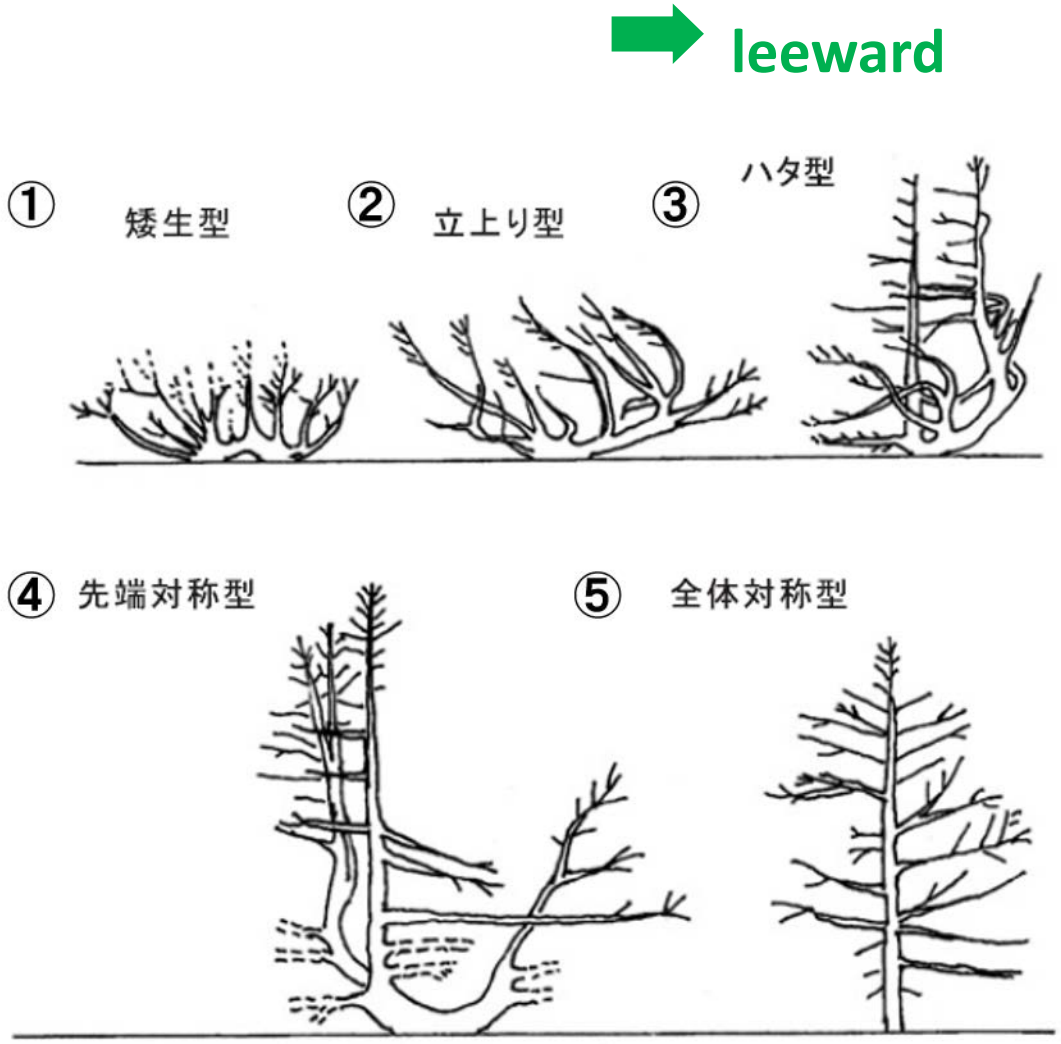
- The most highest mountain in Japan (3776m)
  - An active volcano (no eruption has occurred for about 300 years)
  - The 13th world cultural heritage site in Japan (not a natural one)

- Which has a more beautiful sight from Shizuoka or Yamanashi?
  - I think Yamanashi has (although I`m from Shizuoka……)
  - How about you?

Background

- Timberline is mainly determined based on warm index(Kira,1948)
  - Strong wind and heavy snow are additional factors regulating the line
- The forest of Mt. Fuji doesn`t have *Pinus pumila*
  - *Pinus pumila* is a characteristic species in high mountains
- *Larix* is a pioneer species after disturbances,-eruption
  - Actually, composition around timberline is mostly *Larix*

Form types of *Larix*



①Dwarf type can`t grow vertically.

② ↓some trunks grow leeward

③ ↓some ones glow leeward and vertically

④ ↓some ones also grow windward

⑤Normal type can grow vertically

Comparing these form types…

Larix grows to type② -> ③ -> ④ ?

Fig1. types of *Larix in survey area*

Hypothesis

- Timberline
  - Western slope : 2800m -> optimal height based on warm index(15C°)
  - Southern slope : 2500m-> under the height

- Eruption disturbs the local vegetation -> falling the timberline
  - Western slope : not recorded, oldest… vegetation has all recovered.
  - Southern slope : 300 years ago… vegetation is still recovering now.

Hypothesis『 there is a relation between types of *Larix* and elevation mechanism of timberline 』

Method - Reading aerial photograph

- Using pictures taken in 1962, 1974, 1989, 1999
  - Which include both a top and bottom of the timberline
  - Each area : 100m*300m,　　height : 2450～2570m
  - Count each type's position and size (height<1m)

    except for type⑤ and saplings

※saplings: >1m except for type①

Belt-Transect Method①

- Area : 10m*200m
  - Picked up from each aerial photograph
  - Divided into 8 sites per 10m*25m

1・Every tree measurement

- trees(<1m) and *Larix* saplings : position, height
- *Larix* : type, existence of the strobilus

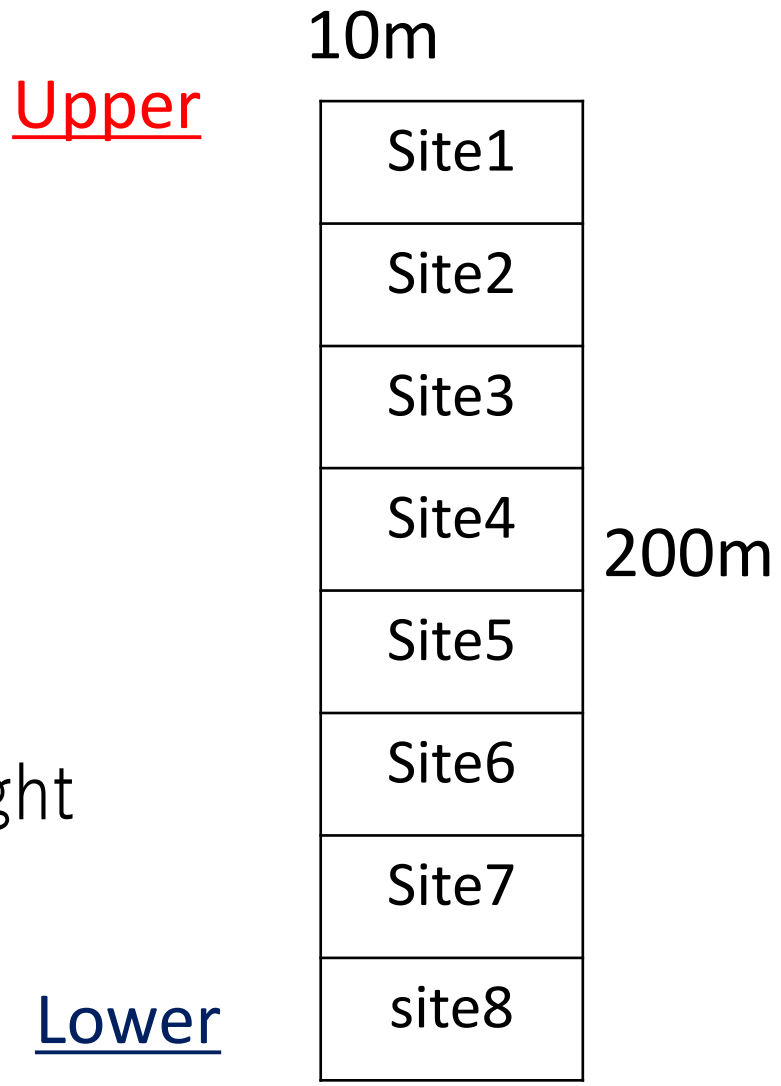


Fig2. survey area

Belt-Transect Method②

2・Stem analysis

- Select a typical individual per type④ and ⑤

->analyze the ages

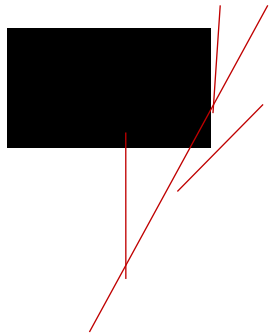


Fig3・plate image

3・Winter environment - wind power -

- Set painted 20cm*10cm plates on the branches of type①, ②, ③
- Ice fragments, sand and gravels brown by wind attack the plates

->Relatively evaluation how these plates would be damaged

Result - Transition of timberline

the individual populations

- rose with age over 2490m (relatively high)
- decreased under 2490m (relatively low) since 1962

->upper area contributes to elevate the timberline

Result - Transition of timberline

The size

- occupied the smallest class (<2m) at over 2530m since 1962
- transited from the smallest to bigger class (4～5m) at mid height since 1989
- always includes bigger class(2～8m) at about 2450m since 1962

->lower area shows that the growth of patch size reached the limit

Distribution of Larix type

The types transited according to their position on the slope

	Type①	Type②	Type③	Type④	Type⑤
Site1	●2				
Site2	●4				
Site3	●2				
Site4	●1	●4	●1		
Site5	●1	●4	●4	●2	
Site6		●1	●7	●1	●3
Site7			●1	●18	●1
site8				●4	●18

Ex.
●5 -> 5 individual
●10-> 10 indivisual and dominant

Fig4. distribution of *Larix* type on each site

Seed production of *Larix*

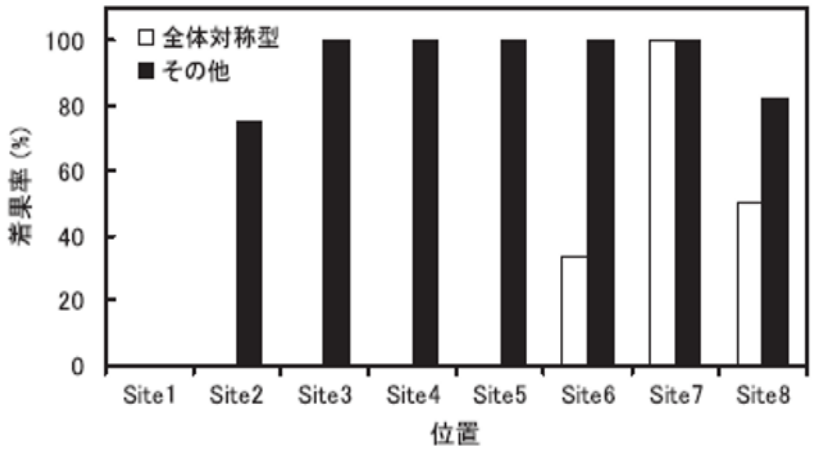


Fig.5. Bearing rate on each site

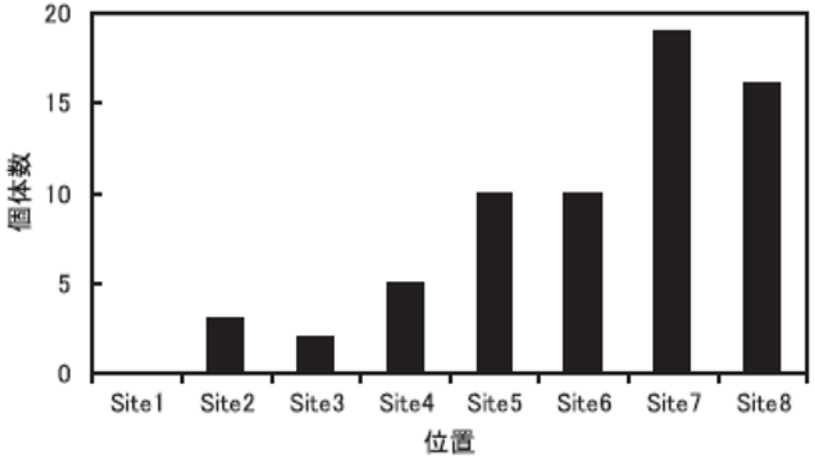


Fig.6. The number of bearing individual on each site

All sites have high production rates.

Even Site2 and site3 that have only type

->Seeds can be supplied to site0

(site0 : upper timberline)

※Site1 is too young to produce

Wind damage Evaluation

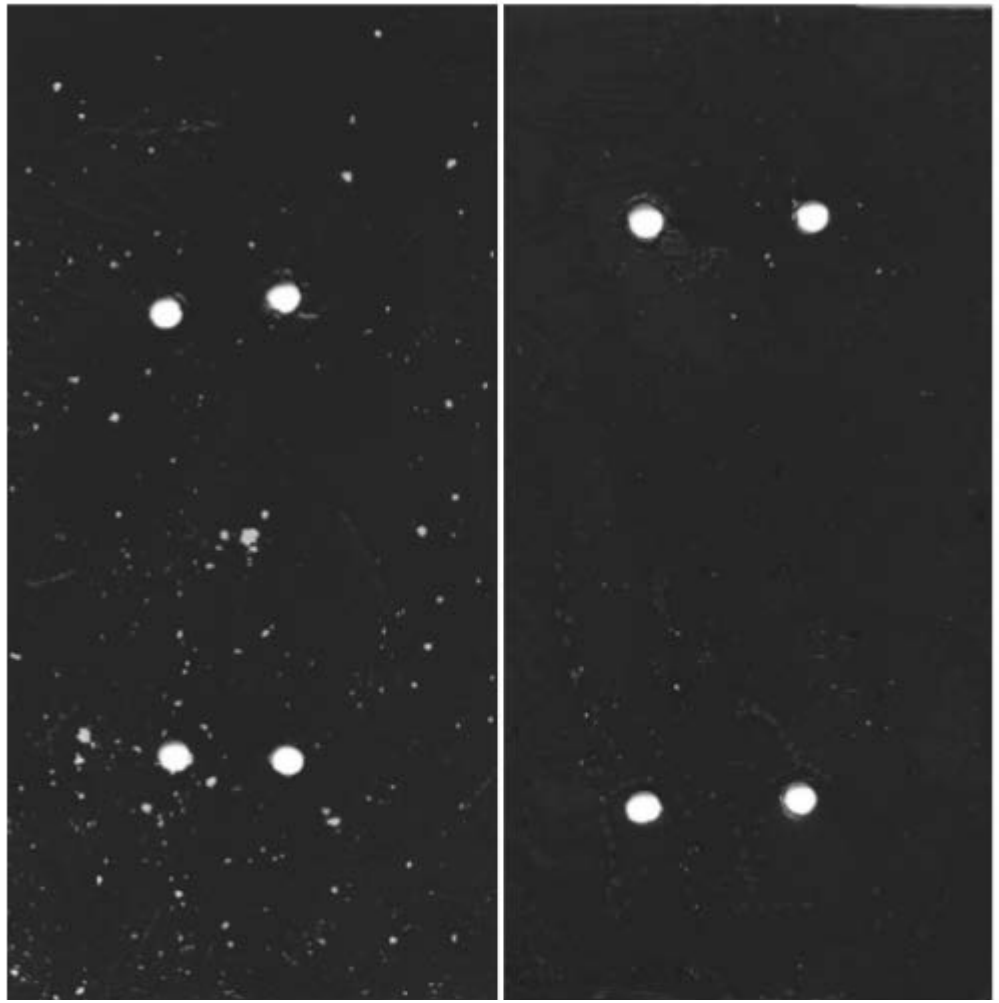


Fig4. damage mark on plates by gravels
left : type① right : type②

- The number of the damage mark
  - Upper site : so many
  - Lower site : a little

※ not related to their type

-> wind power is gradually weakened toward lower site.

Comparing between type④ and type⑤ [stem growth]

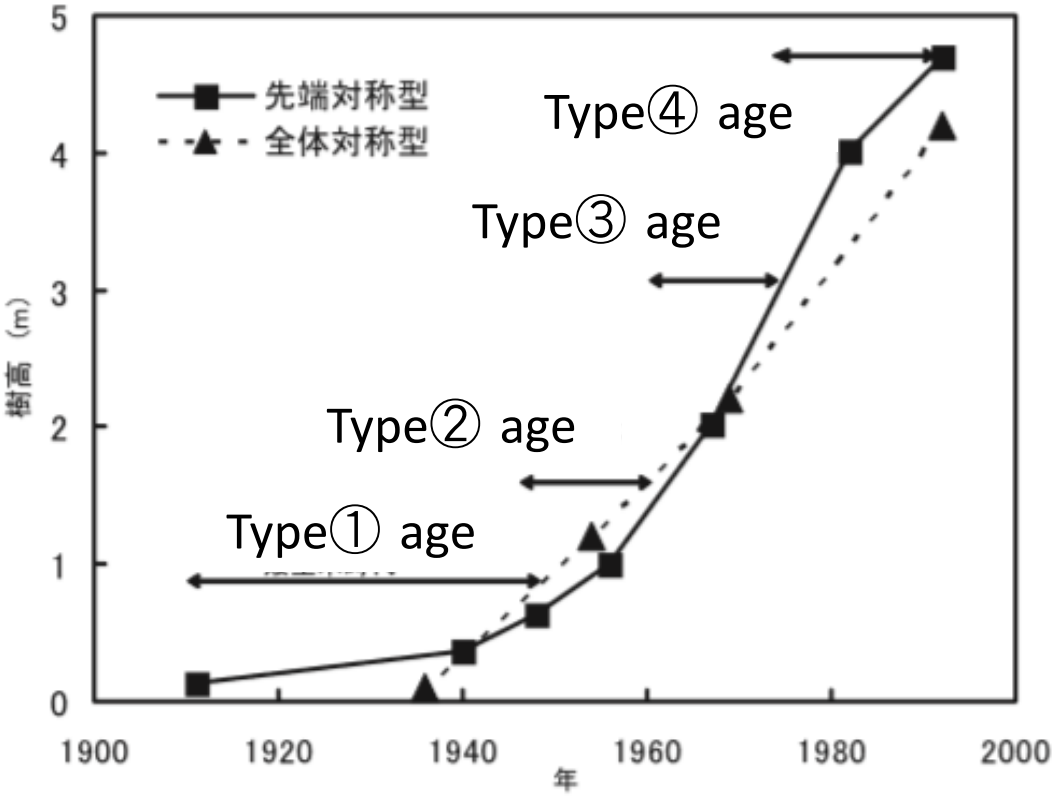


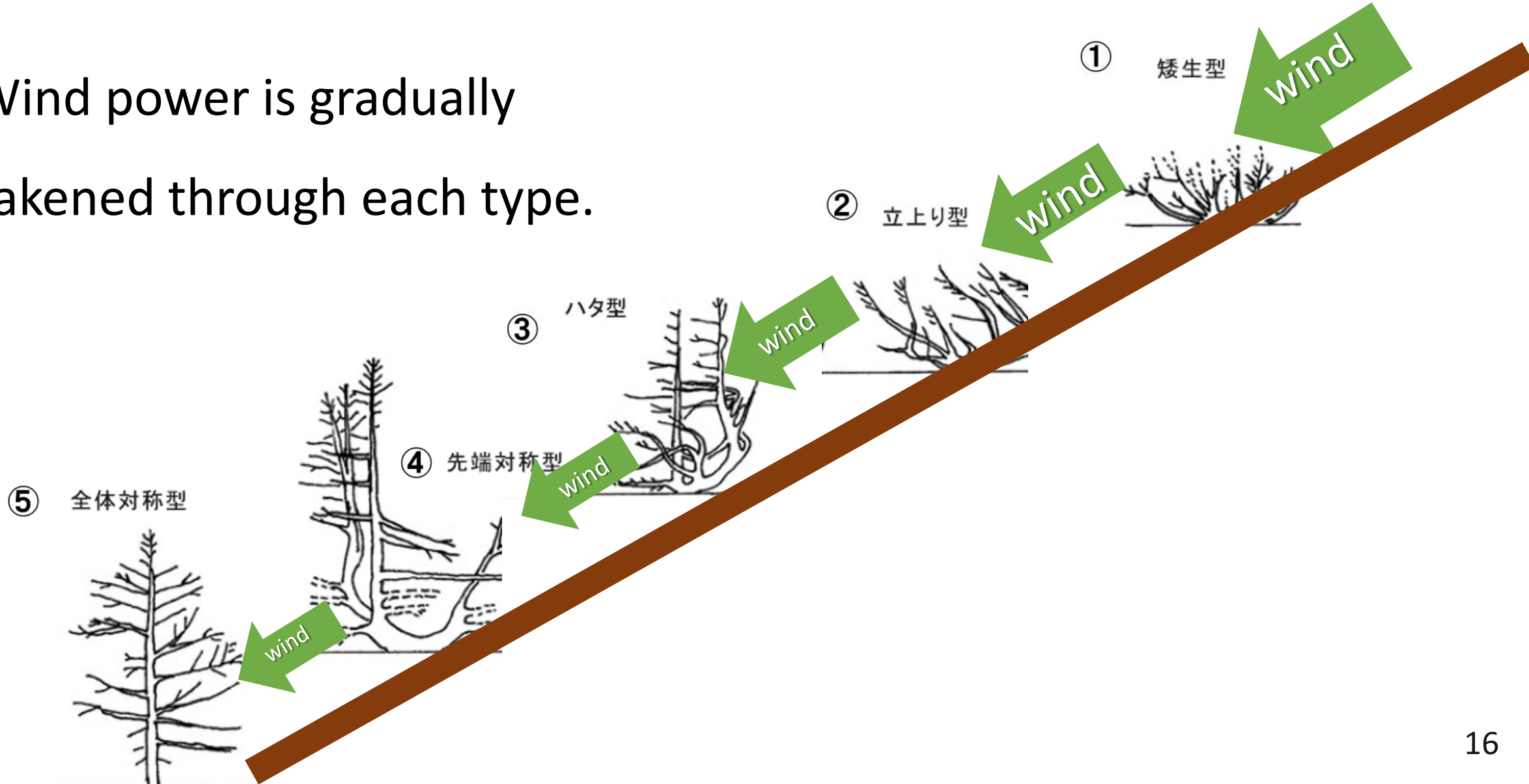
Fig5. stem growth process of type④ and type⑤

- Type④ process consist of 4 ages
- Period from age① to age② was coincident with starting of type⑤
- Two growth rates were close After age②

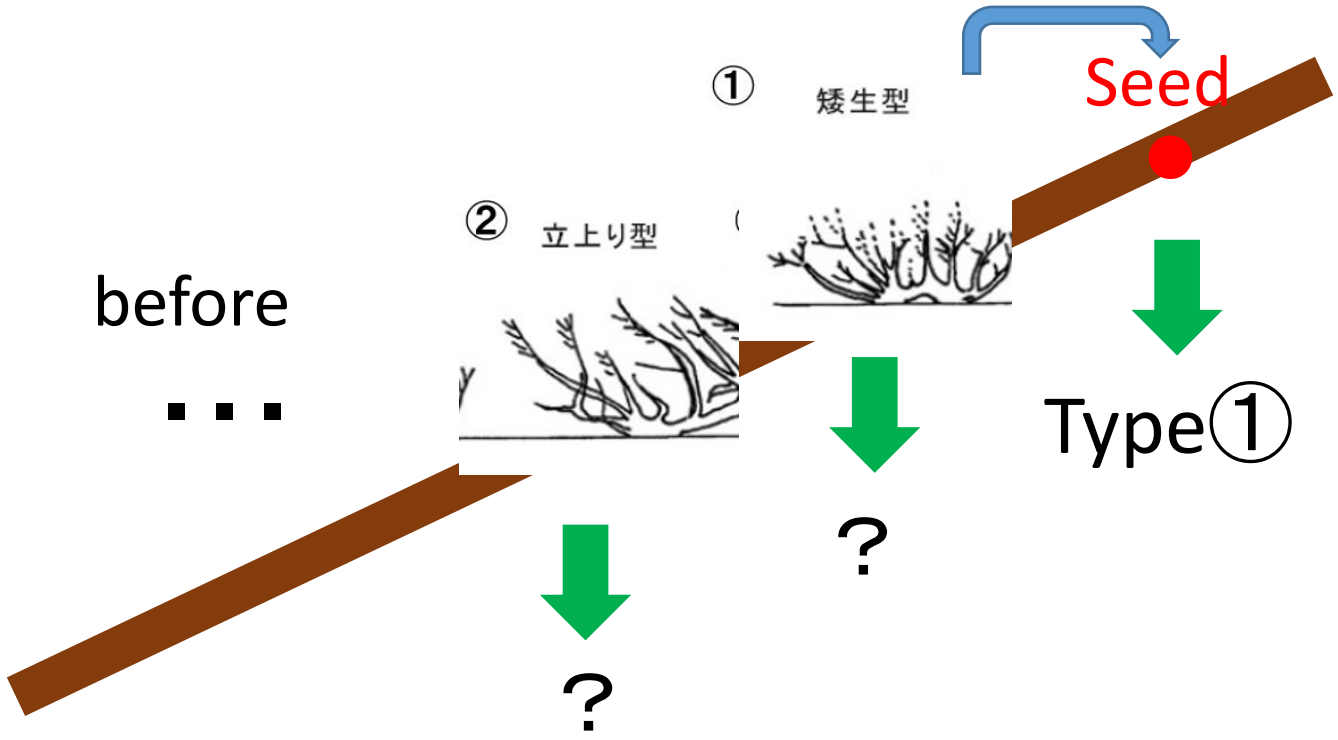
->type① promote the growth other types.

Discussion – wind power and distribution

- Wind power is gradually weakened through each type.



Transition of timberline




type① sprays the seeds

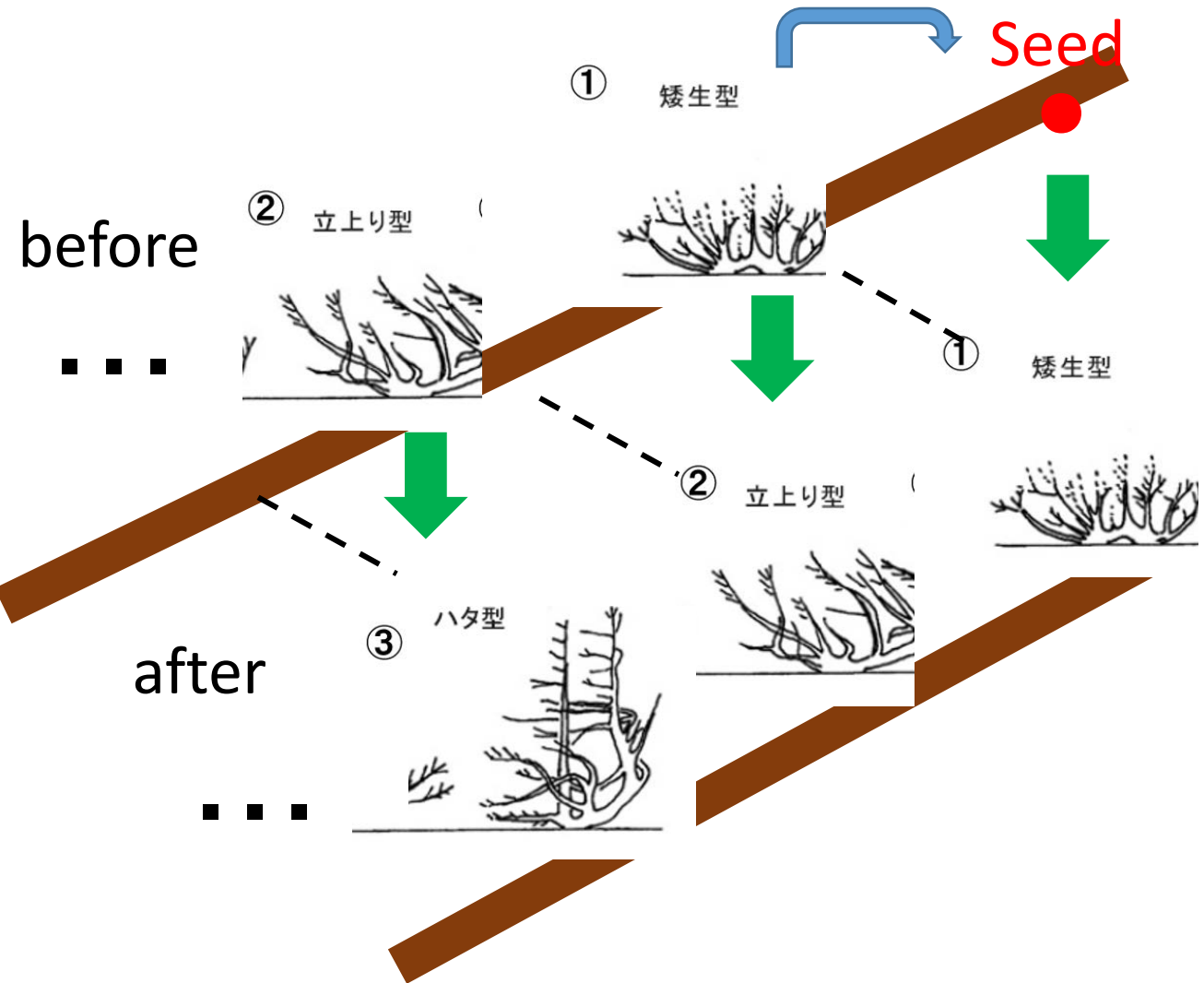
on the upper slope

->new type① grows

-> what happened?

Point : Type① helps the others grow

Transition of timberline



Type①->type②,

type② ->type③, …

This process occur again and again…

-> <u>rising of timberline</u>

Conclusion – characteristic timberline

Other mountains

- The line has already risen to maximum height
- Forest composition has adopted to the environment there

–> stable forest

Mt. Fuji

- The line is still rising now toward the primary height
- *Larix* is a pioneer species and exchanged by other species

–>Forest composition continues to adapt, is not stable at one position