Climate change impact and vulnerability assessment on Japanese forests

（温暖化の森林への影響と脆弱性の評価に関する研究）

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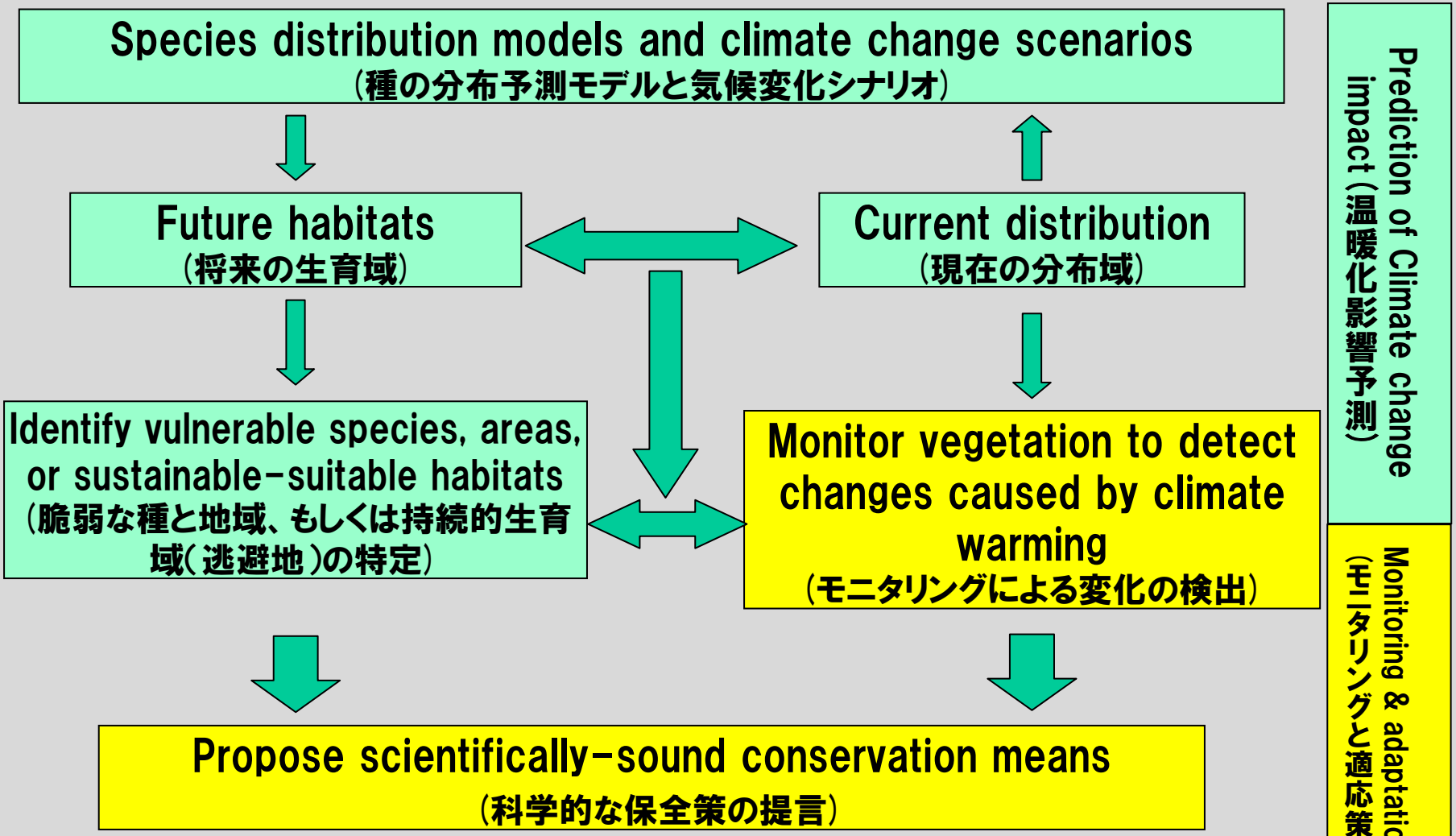
Prediction of climate change impacts on natural forests and adaptation means

（自然林における温暖化影響の予測と適応策）



Prediction of climate change impact on forests
(温暖化の森林への影響予測)

1. Beech forests in Japan
   (全国のブナ林)
2. Beech forests in the Shirakami-Sanchi (Mts.) World Natural Heritage area
   (白神世界遺産地域のブナ林)
3. Pine wilt disease
   (マツ枯れ)

Beech (*Fagus crenata*) forests: one of the representative Japanese forest ecosystems

(ブナ林は日本を代表する森林生態系の1つである)

- They distribute from Kyushu to Hokkaido
  (九州から北海道まで広く分布する)

- >800 plant species, large mammals and raptors inhabit
  (800種以上の植物や大型野生動物が生息する)

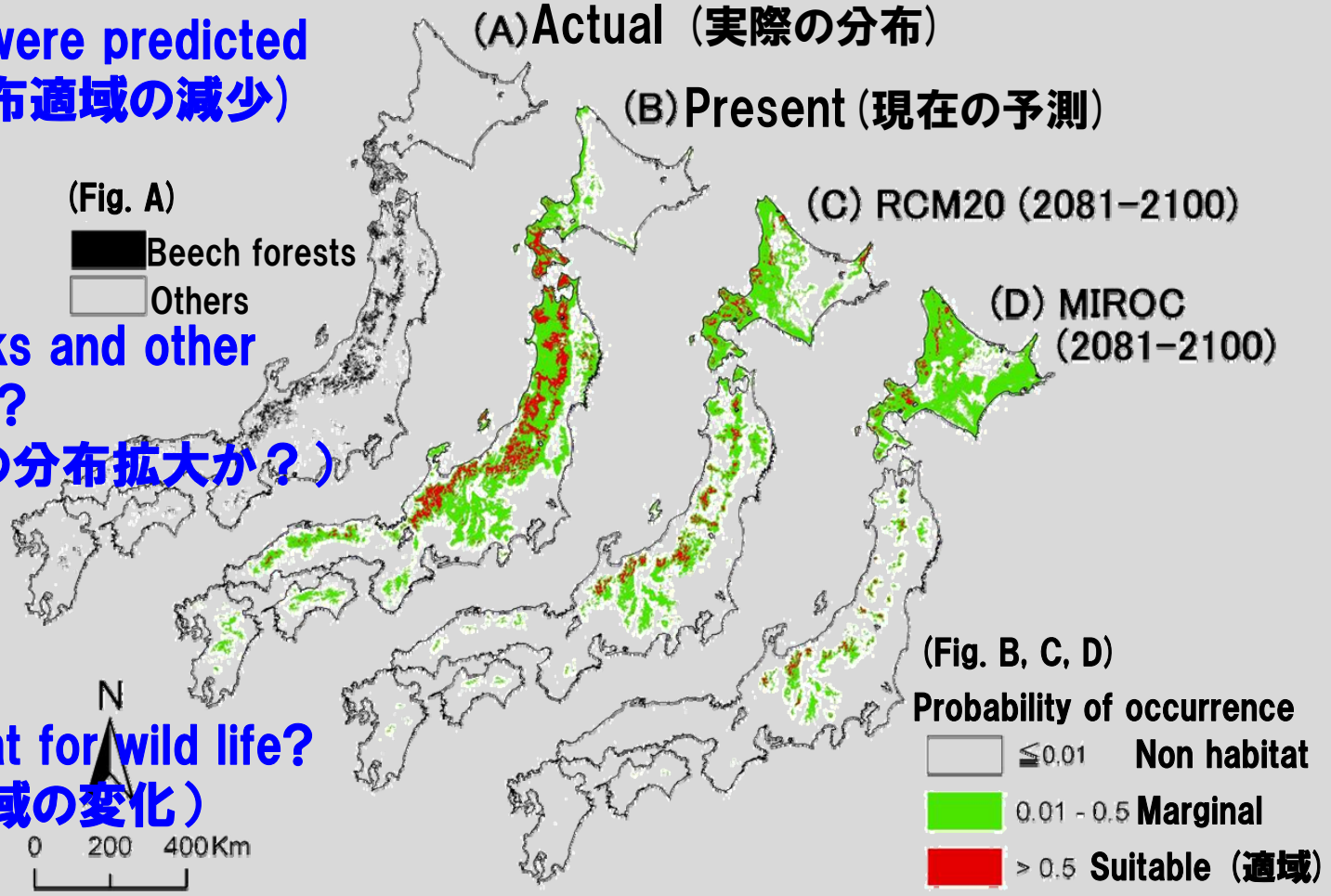
- Shirakami Mts. are designated as World Natural Heritage sites
  (白神山地は世界自然遺産である)

Predicted habitat shifts for beech forests under the RCM20 & MIROC scenarios
（予測された分布適域の移動）

Suitable habitats were predicted to decrease （分布適域の減少）

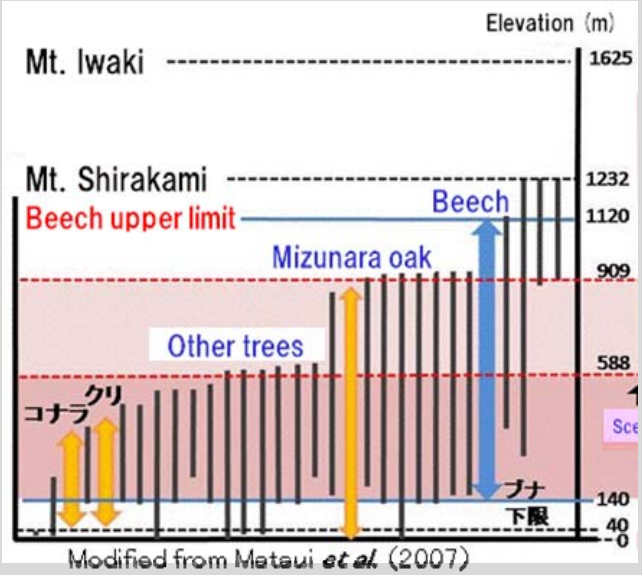
Expansions of oaks and other evergreen forests?
（ナラ類や常緑樹の分布拡大か？）

Changes of habitat for wild life?
（野性生物の生息域の変化）

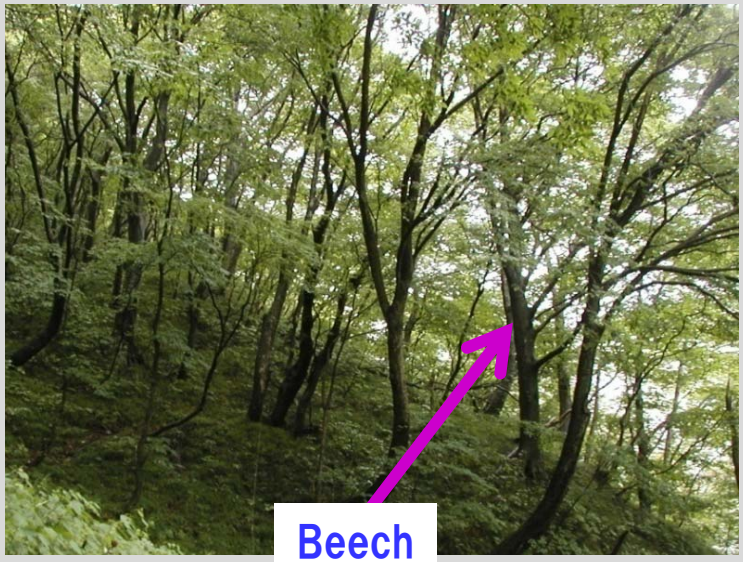


Matsui *et al.* (2009a,b)

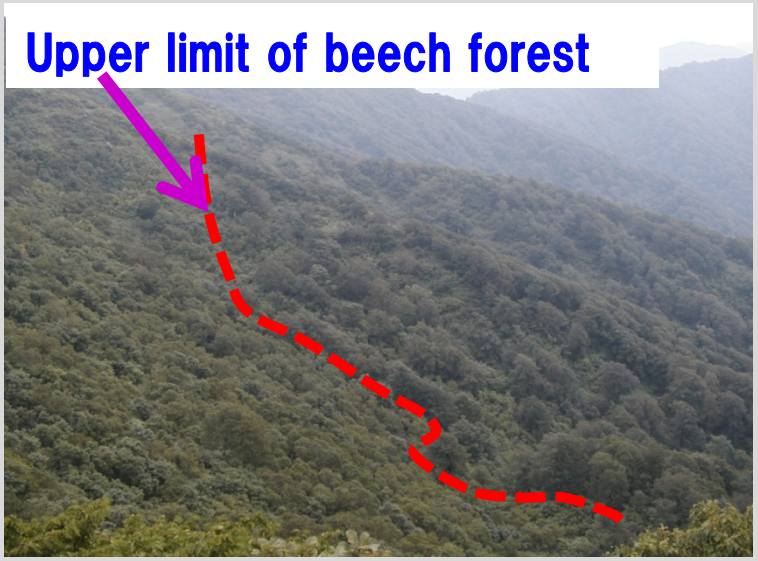
Beech in the Shirakami Mts. World Natural Heritage Area
(白神山地世界遺産地域のブナ林)



Pure beech forest at middle elevation



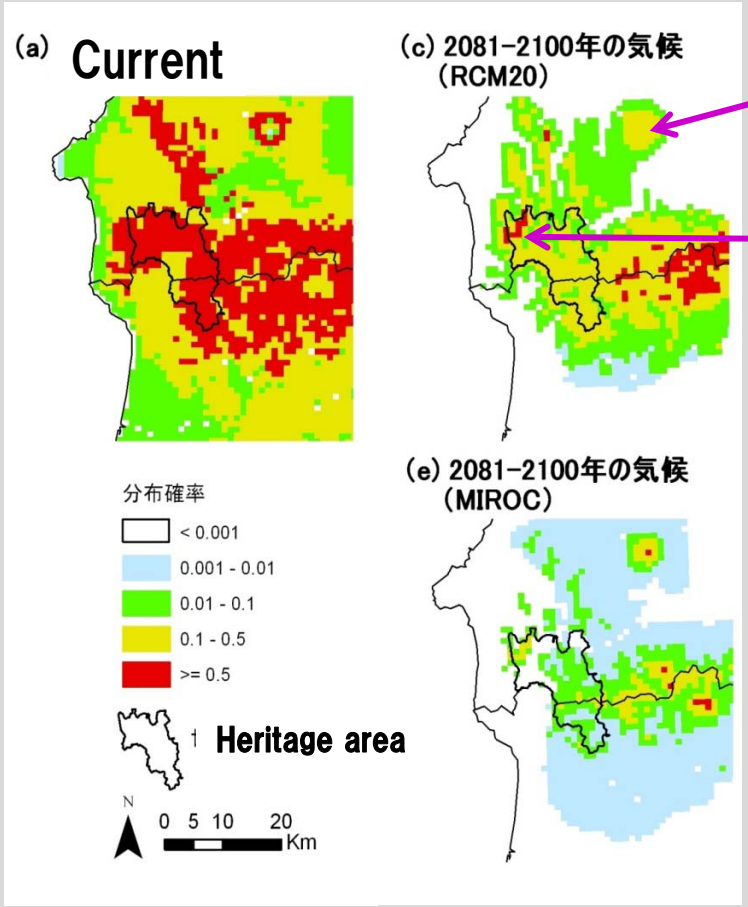
Mixed forest at low elevation of 140 m



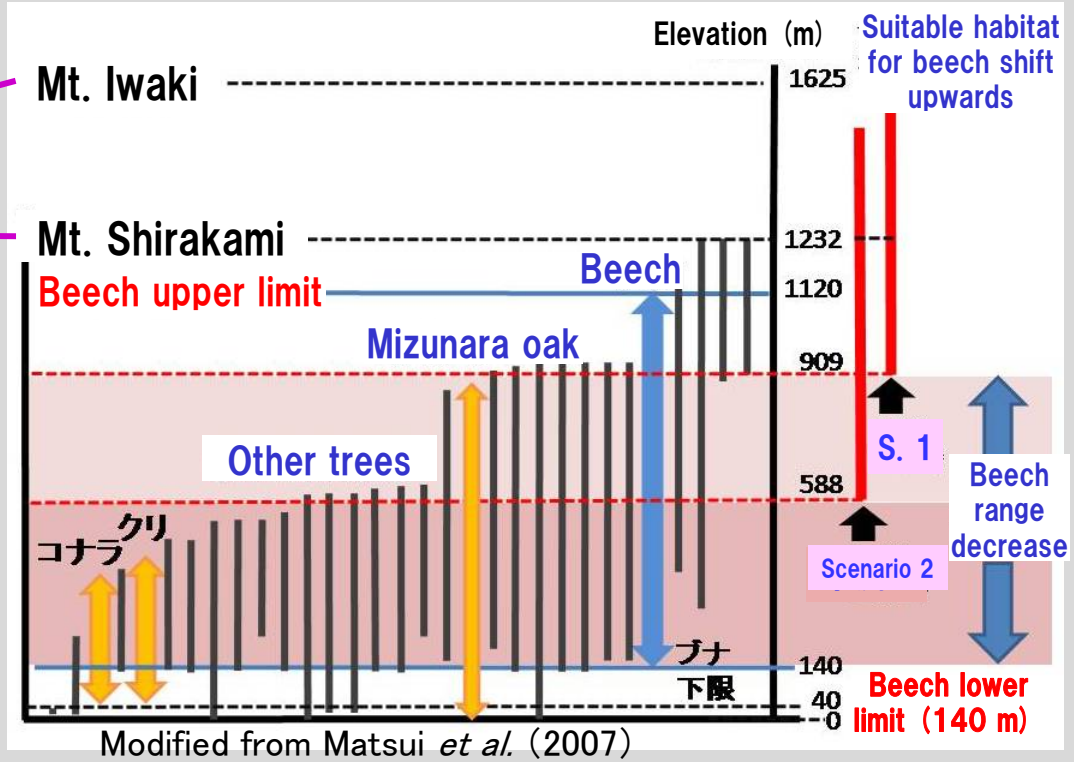
At high elevation

Predicted habitat shifts for beech forests in the Shirakami Mts. World Natural Heritage Area

（白神山地世界遺産地域のブナ林分布確率の将来予測 ）



Matsui *et al.* (2007, 2009b)



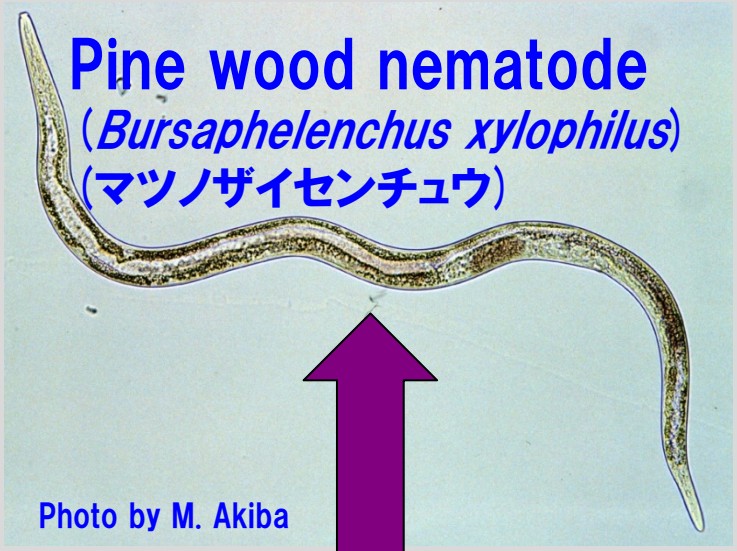
Modified from Matsui *et al.* (2007)

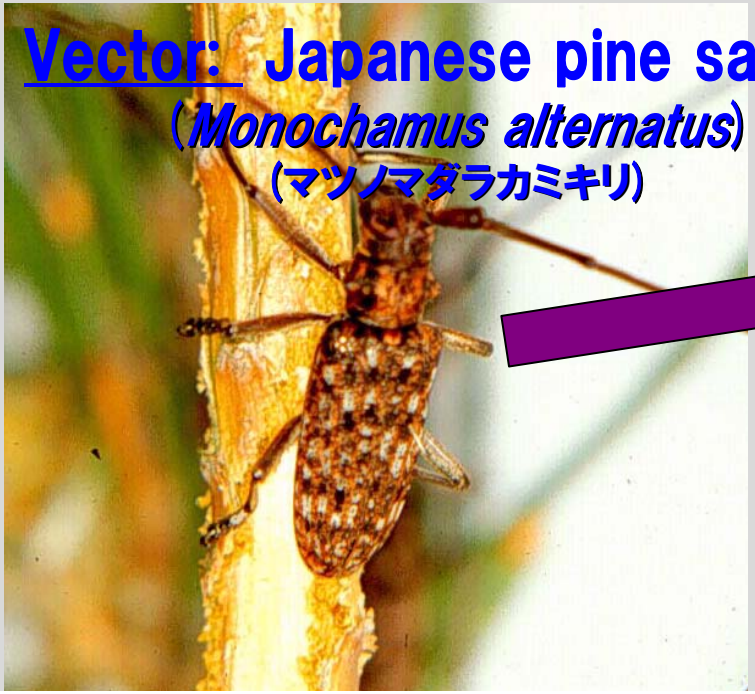
- Suitable habitats were predicted to decrease （生育適域は将来減少）
- MIROC in 2100 maintains no suitable habitats within the heritage area （MIROCの2100年シナリオでは遺産地域内の生育適域は消滅）

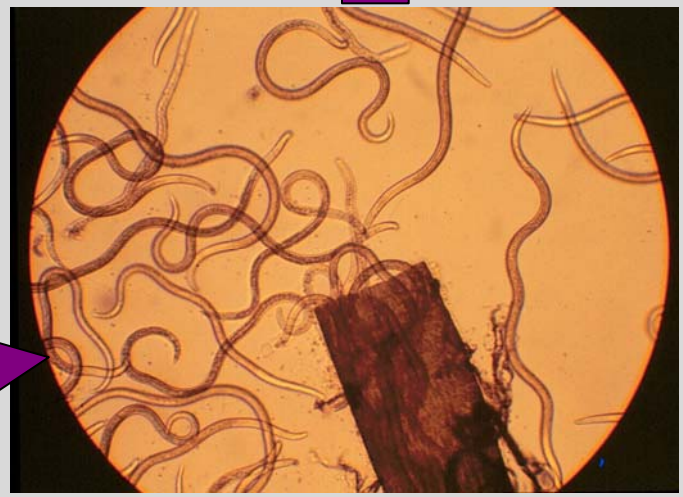
Pine wilt disease : the worst forest damage
(マツ枯れ:最悪の森林被害)

●An insect-mediated infectious disease with the pine wood nematode as a pathogen
(マツ枯れの原因は、マツノザイセンチュウを病原体とする昆虫媒介性の伝染病)

●Sensitive to temperature change
(温度に対し感受性が高い)



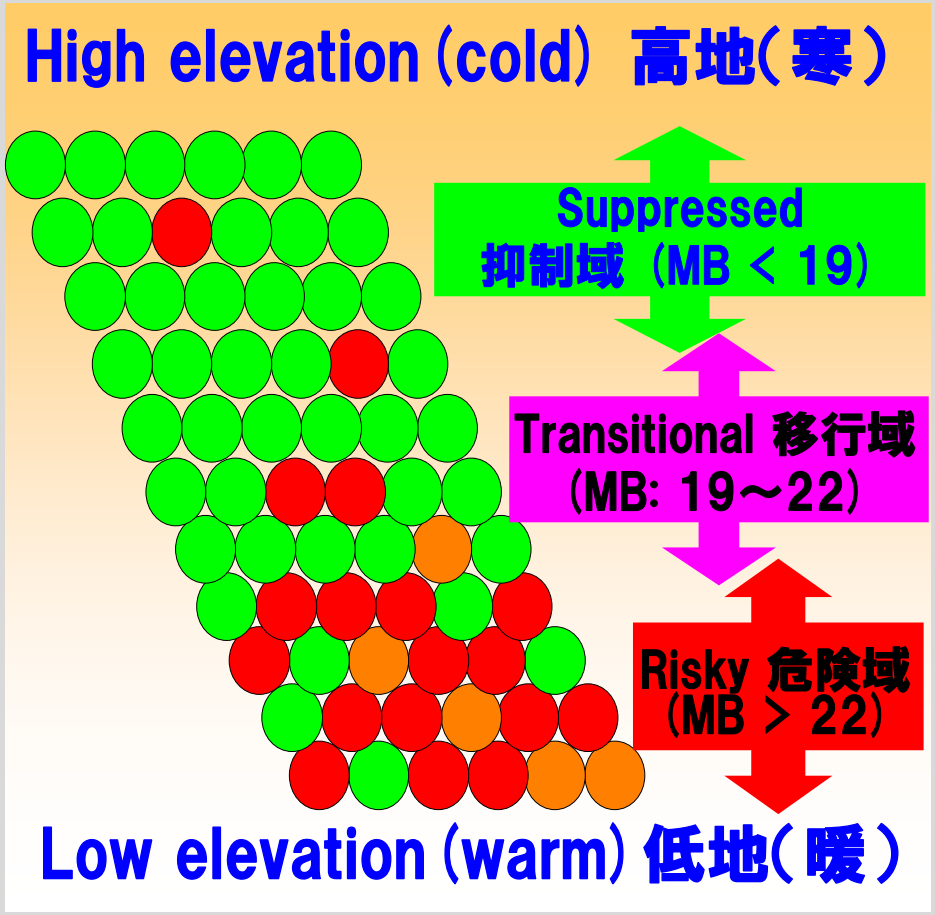




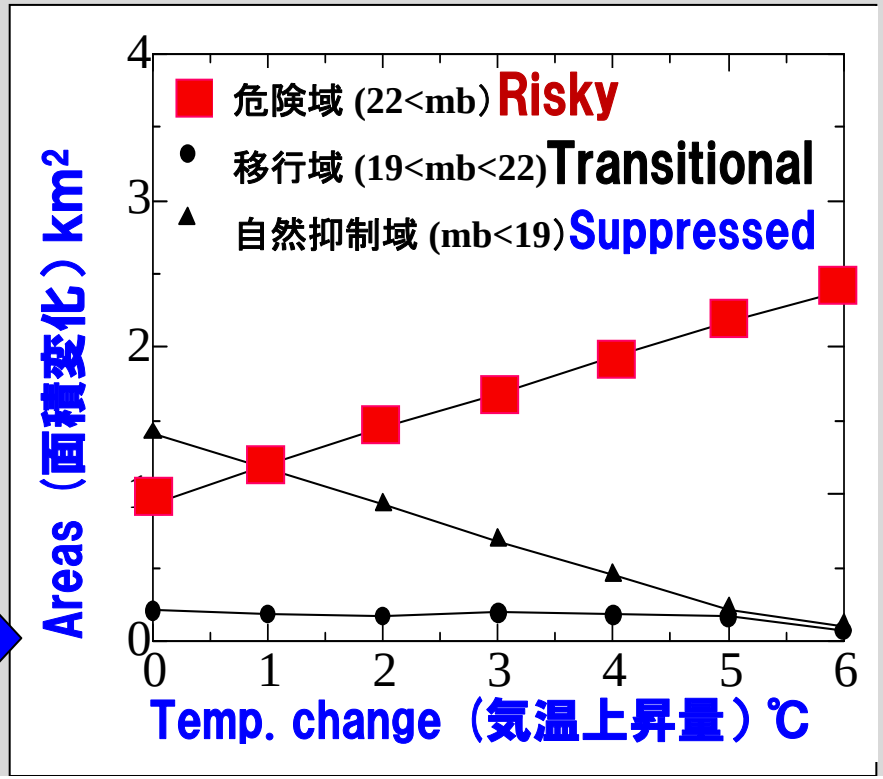
Emigration of pine wood nematode from the trachea of a Japanese pine sawyer (マツノマダラカミキリの気管から遊出するマツノザイセンチュウ)

The MB index: the accumulated temperature for the risk evaluation of the pine wilt disease

（積算気温であるMB値により、マツ枯れリスクを推定する）



- MB index is used to predict the occurrence of pine wilt disease, which was developed from the growth characteristics of the pinewood nematode and the Japanese pine sawyer
- MB値はマツノザイセンチュウとマツノマダラカミキリの生育特性から推定された、マツ材線虫発生予測指数



- Risky areas were predicted to increase with temperature increase

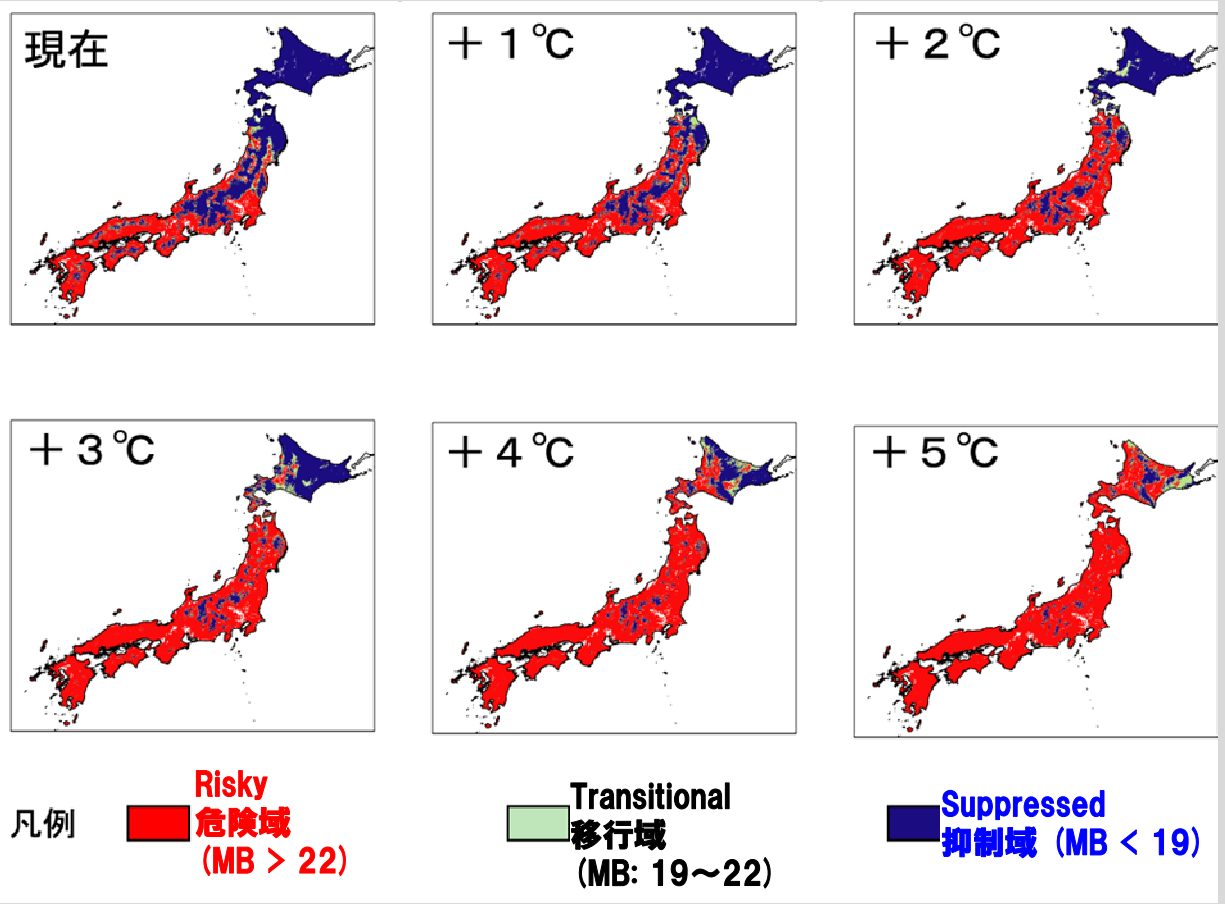
気温上昇と共に危険域の面積増加

Potential range shift of the areas at risk of pine wilt disease under simulated temperature change
気温上昇に伴うマツ枯れリスク域の変化

Pine wilt damage has been observed as far north as to Akita Prefecture at the present (現在は秋田が北限)

The risk of pine wilt damage will increase with global warming (温暖化で被害増加)

>2 ℃, pine wilt would devastate pine forestry and Matsutake mushroom production
(2℃以上温暖になるとマツタケとマツ材産業に甚大な被害)



Monitoring studies

1. Beech forest on Mt. Tsukuba

2. Mountain bogs on Mt. Hiragatake

Vulnerable beech forest on the Pacific Ocean side: ex. Mt. Tsukuba in Ibaraki Pref. (Elev. 800 m)

太平洋側低山の脆弱なブナ林（冬季の筑波山、標高800m）

Decline of beech canopy, due to warm and less snowy climate conditions

（温暖な気温と少雪によるブナ林の衰退）

Beech monitoring program was launched

（ブナのモニタリングが開始）

Detection of climate change impact on the bogs on Mt. Hiragatake (2,141 m)

温暖化影響検出:平ケ岳の山岳湿原

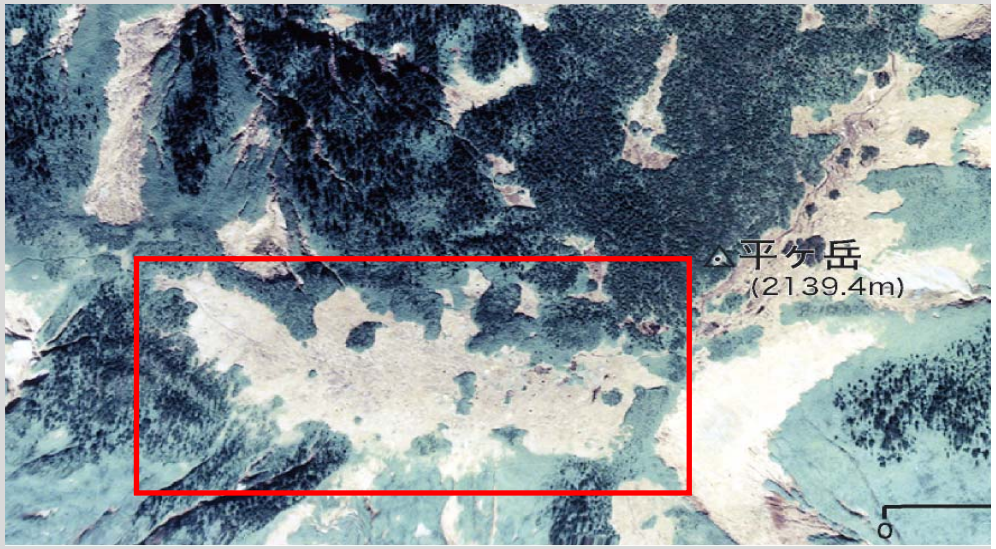
- Water source is rainfall and snowfall only
  (積雪と降雨が涵養源である)
- Invasion of *Sasa* and dwarf pine into the bog caused dryness and reduction of bog vegetation
  (ハイマツとチシマザサの湿原への侵入による乾燥化が進行)

However,

- Detailed reduction of bog areas and vegetation changes was unknown
  (湿原の縮小や植生変化の実態は不明)

Changes in the bog areas were examined by comparing a series of orthonized aerial photographs taken between 1971 and 2000

（平ヶ岳山頂部の湿原面積を、複数のオルソ空中写真の比較により測定）

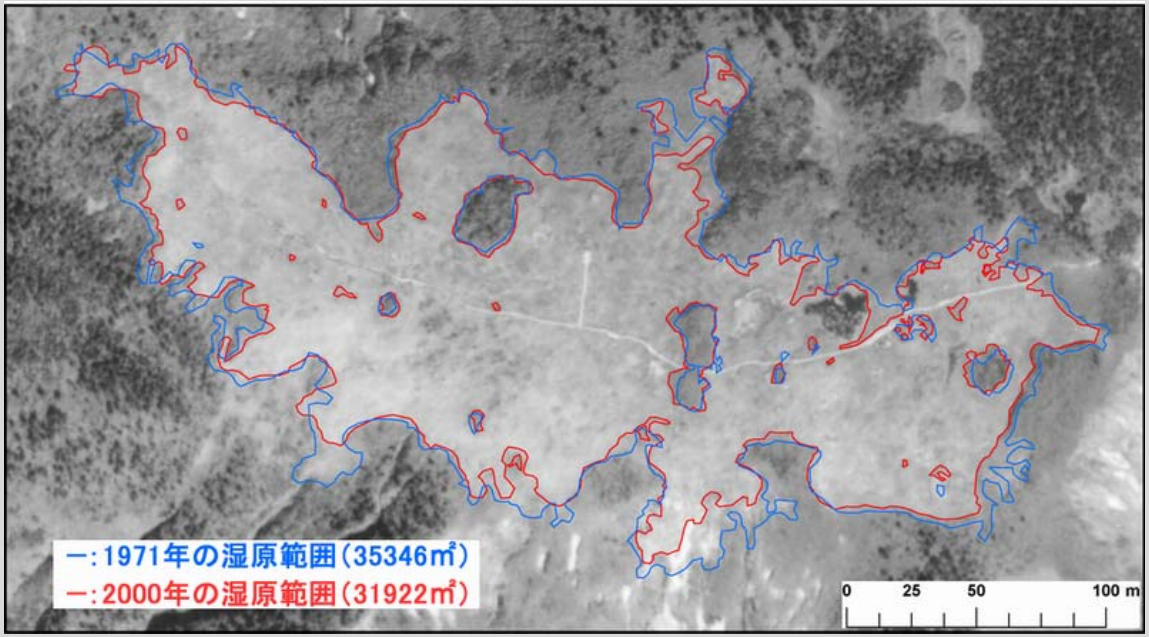


The bog areas decreased to 90% in the last 30 years

（湿原面積は過去30年で90%に減少）

Due to recent mild winters with less snow, the mountain bog have been shrinking

（積雪量の減少が原因で、湿原は縮小している）



Yasuda *et al.* (2007)

Thank you for your attention

ありがとうございました