

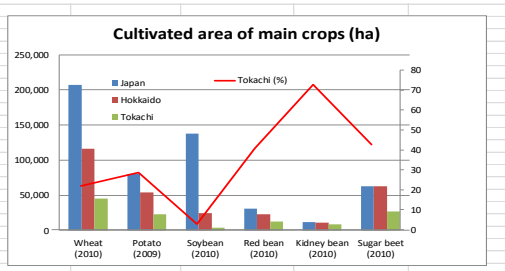
# Natural History of Hokkaido as revealed in soils

Re-edited for 2019, Part 2

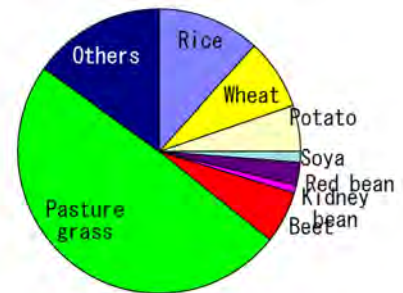
Obihiro Univ. Agr. Vet. Med.  
Kiyoshi Tsutsuki

## Agriculture in Tokachi History and present situation

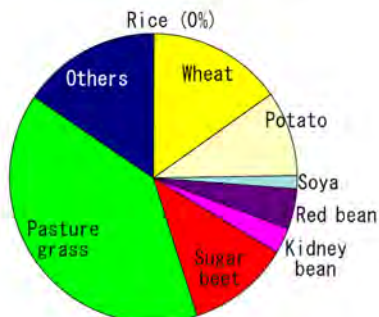
### Cultivated area of main crops in Japan, Hokkaido, and Tokachi



### Area of main crops (Hokkaido)

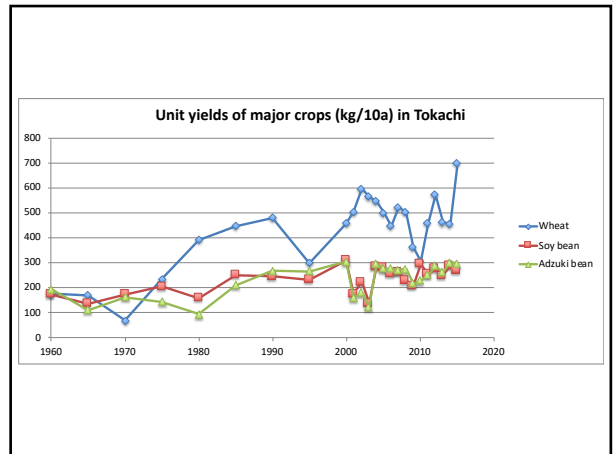
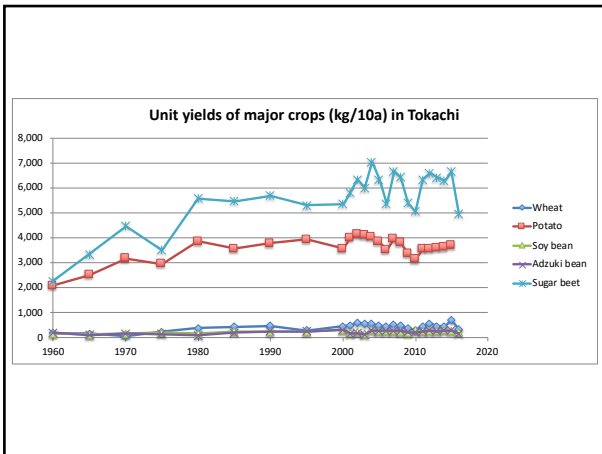
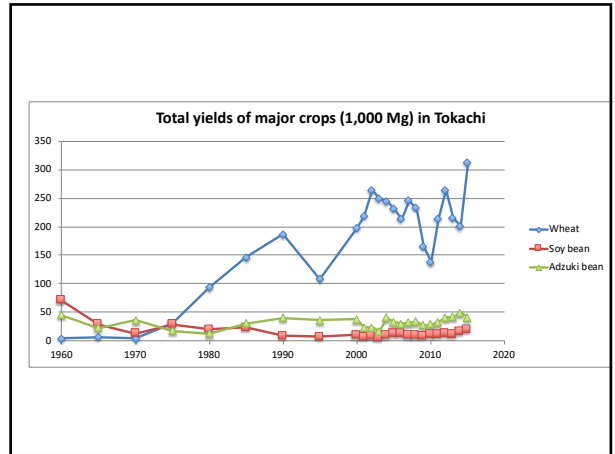
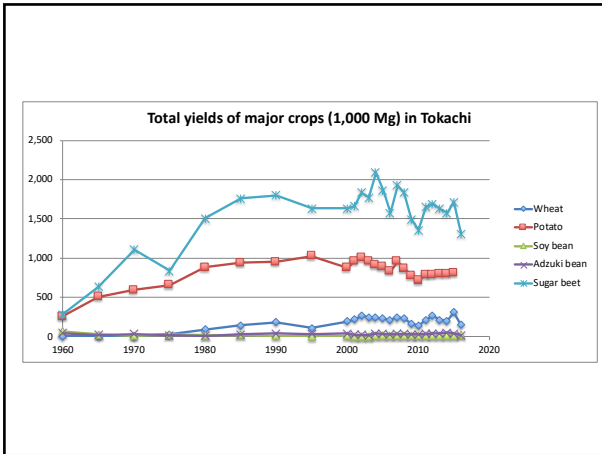


### Area of main crops (Tokachi)



### Comparison of Agricultural Production between Japan, Hokkaido, and Tokachi (2016)

	unit	Japan	Hokkaido	Tokachi	Tokachi/Japan(%)
Wheat	1000 Mg	790.8	524.3	151.4	19.1
Potato	1000 Mg	2406	1907	805.8	33.5
Sugar beet	1000 Mg	3189	3189	1308	41.0
Soy bean	1000 Mg	238	84.4	22.4	9.4
Adzuki bean	1000 Mg	29.5	27.1	17.9	60.7
Kidney bean	1000 Mg	5.65	5.48	4.12	72.9
Cow milk	1000 Mg	7394	3923	1150	15.6
Beef cow	1000 Head	2274	491	224.6	9.9




### Contribution to sugar-beet production

- Introduction of paper pot transplanting technique
- Land improvement (amelioration of soil acidity, drainage of land)
- High yielding variety

### Contribution to red bean (Azuki) production

- High yielding variety (Erimo variety since 1981)
- High income for farmers
- Special product of Tokachi due to high quality

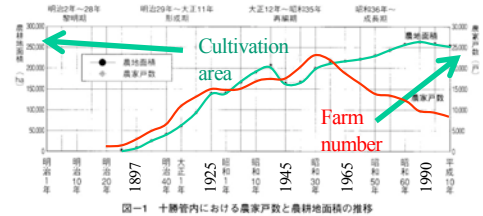


Rice ball coated with sweet Azukibean paste.

## Contribution to wheat production

- Agricultural policy to support wheat production
- High yielding variety (Chihoku, Hokushin)
- Low labor input

## Number and cultivation area of farms in Tokachi

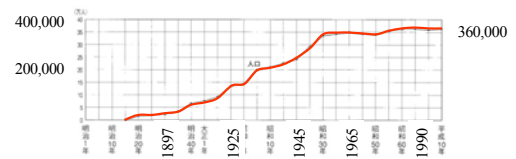


図一 十勝管内における農家戸数と農耕地面積の推移

## Why agricultural population decreased in Tokachi?

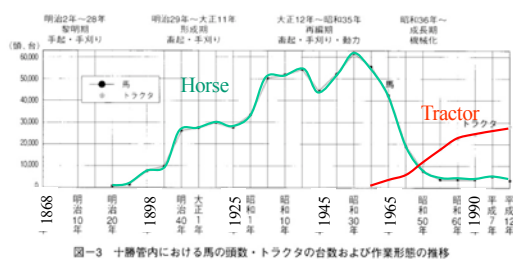
- Merit of large scale operation of agriculture
- Outflow of labor force to industrial, commercial, and civil service

## Population change in Tokachi



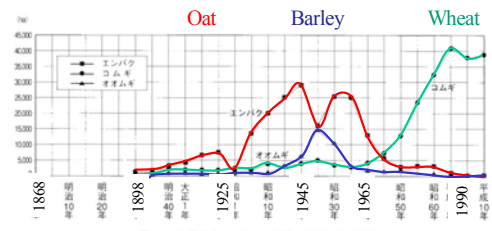
図二 十勝管内における人口の推移

## Number of horse and tractors in Tokachi



図三 十勝管内における馬の頭数・トラクタの台数および作業形態の推移

## Area of wheat, barley, oat in Tokachi

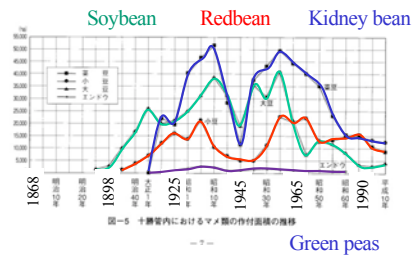


図四 十勝管内におけるムギ類の作付面積の推移

## Why oat and barley decreased

- Oat and barley had been used as forage of horses.
- Horses for plowing were replaced by tractors.

## Cultivated area of pulses in Tokachi



## Why soybean decreased

- Due to low international price.
- Import is freed and cheap soybean is imported from USA and South America
- Only special good variety can survive in Tokachi

## Redbean (Azuki bean)



## Kidney bean



## Soybean



## Area of Sugar-beet and potato cultivation in Tokachi

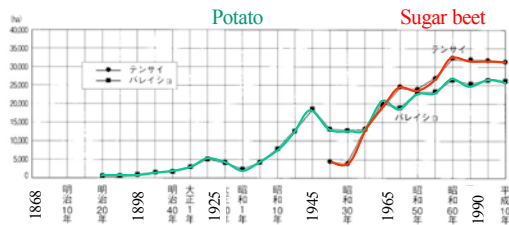


図-7 十勝管内におけるテンサイおよびパレイシヨの作付面積の推移

## Sugar beet



## Potato (May Queen)



## Number of Dairy cows and area of pasture in Tokachi

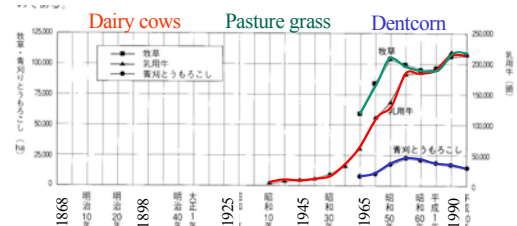
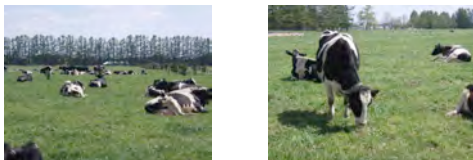


図-8 十勝管内における乳牛頭数・牧草地・青刈りとうもろこしの作付面積の推移

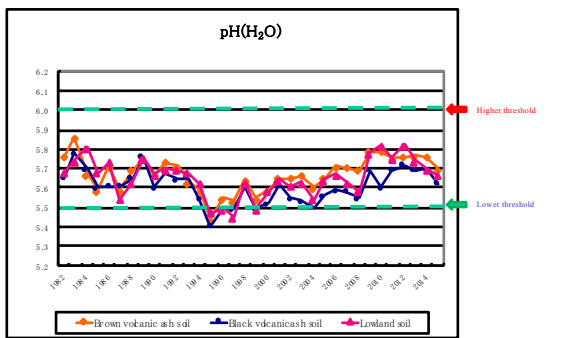
## Dairy cow and pasture



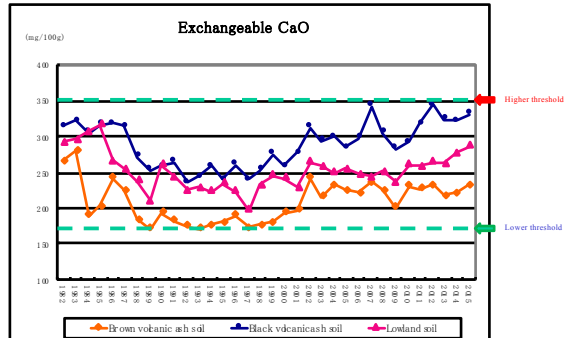
Farm of Obihiro Univ. A. V. M.

## Various problems for soils in Tokachi

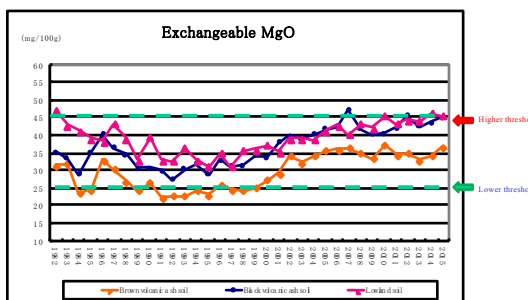
- Decreasing soil pH
- Imbalance in soil nutrition (Excess  $P_2O_5$ , decrease in Ca, Mg)
- Micronutrient deficiency (Cu, Zn, Mn, B)
- Deterioration of soil physical properties
- Soil erosion
- Water and land pollution by animal wastes



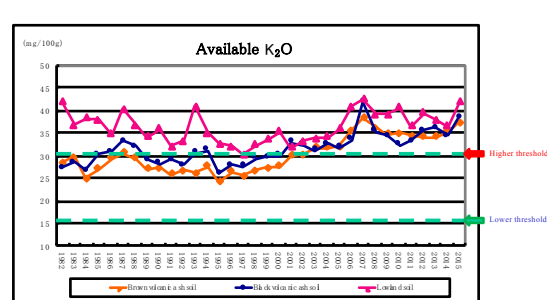
Change in soil pH in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.



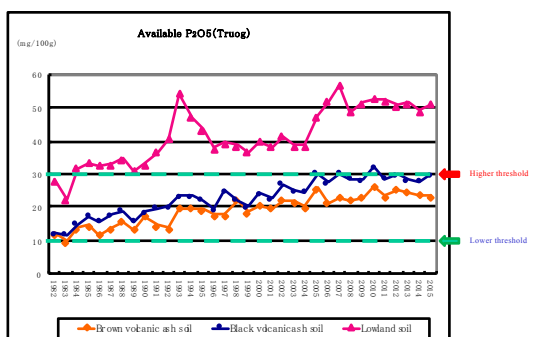
Change in exchangeable CaO in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.



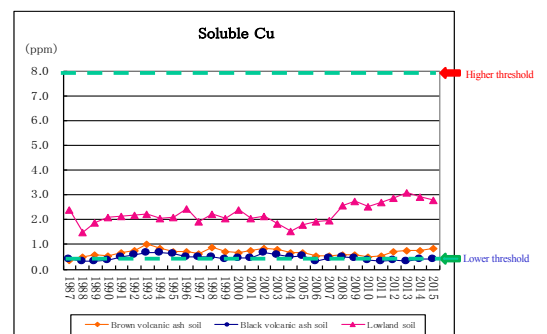
Change in exchangeable MgO in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.



Change in exchangeable K<sub>2</sub>O in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.



Change in available P<sub>2</sub>O<sub>5</sub> in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.



Change in soluble Cu in Tokachi; normal Andosols, wet Andosols, and lowland soils. Data: Tokachi Federation of Agricultural Co-operatives.

## Problems of volcanic ash soils

- Strong acidity
- Poisonous active aluminium
- High phosphate absorption and low available phosphate
- Low in nitrogen and bases
- Soil drying in normal Kuroboku soil
- Wet damage in wet type Kuroboku soil

## Merit of volcanic ash soils

- Soils are soft and easily plowed
- Humus holds exchangeable bases

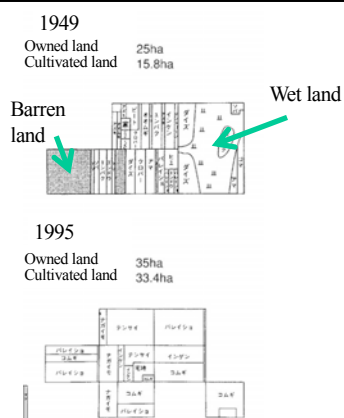
## How to improve volcanic ash soils

- Soil survey and soil diagnosis help decide the goals and methods of soil improvement
- Amelioration of soil acidity by liming
- Application of phosphate material
- Application of NPK

## Improving techniques

- Mixing plow, Reversible plow, Subsoil plow
- Open ditch and underground ditch
- Organic matter application
- Deep plowing by tractor

## Landuse change by one farmer in Tokachi



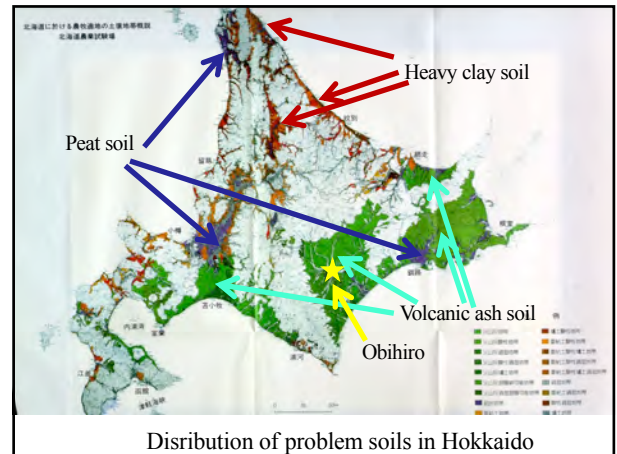
## Three stages in soil fertility

Concept by Prof. Kikuchi

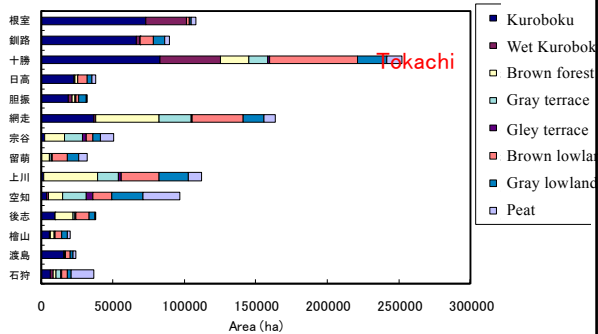
- Stage 1: Natural soil fertility with various constraints
- Stage 2: Improved fertility by adjustment of relief, land drainage, mixing and reversing soil layers, soil acidity amelioration, etc.
- Stage 3: Improved fertility by proper fertilizer application, cropping system management for high quality and sustainability.

## Special Problem Soils in Hokkaido

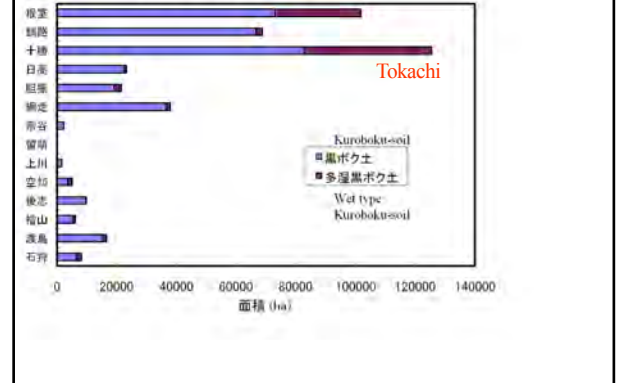
- Not only the harsh climate, soil itself forced a hard labor to pioneers and farmers in Hokkaido.



Area of various soil groups in Hokkaido

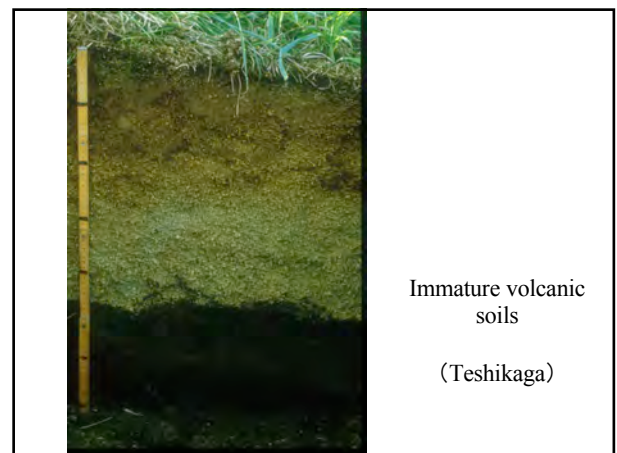


Area of Kuroboku soils in Hokkaido

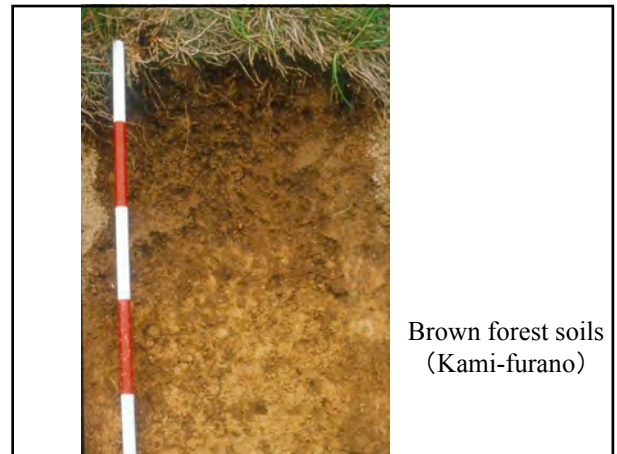
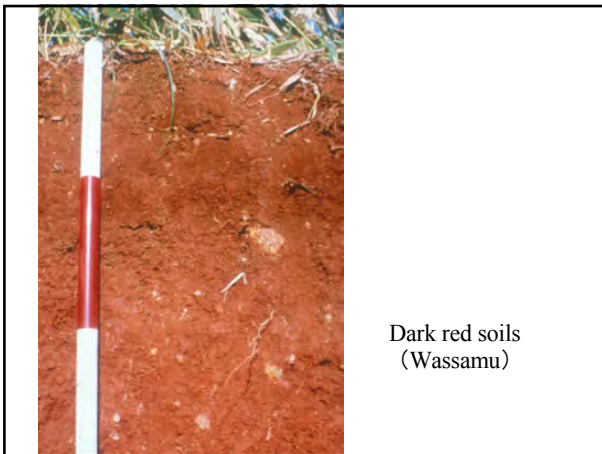
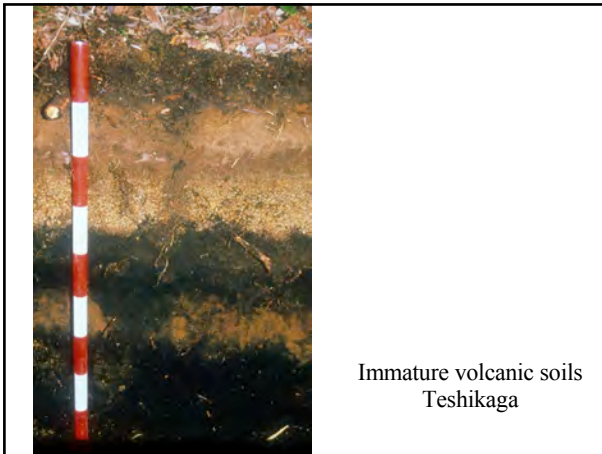


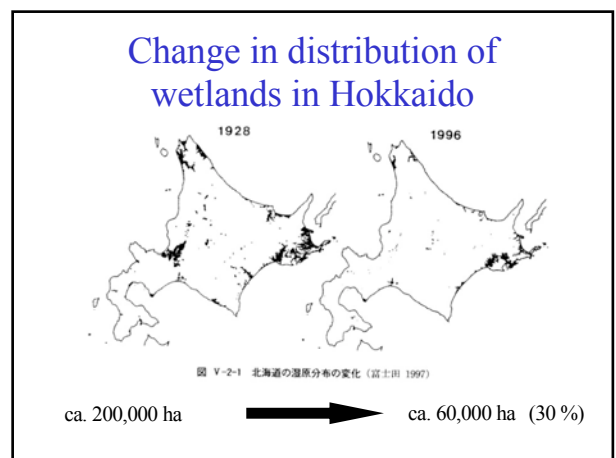
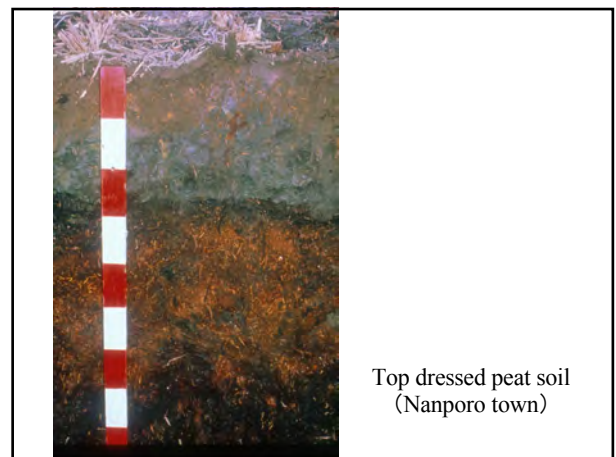
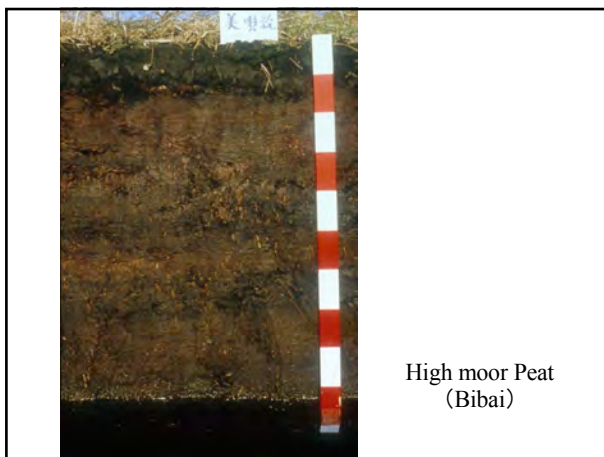
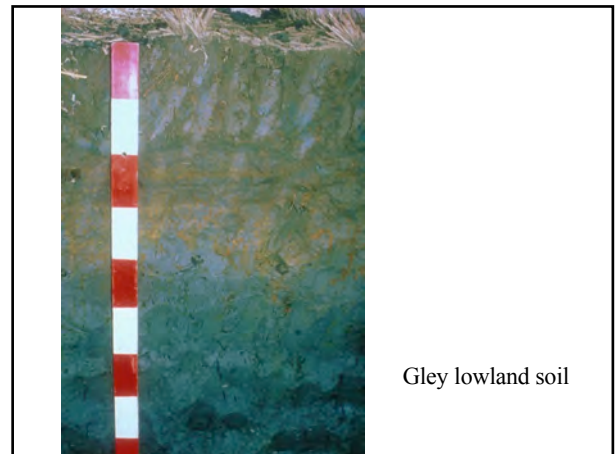
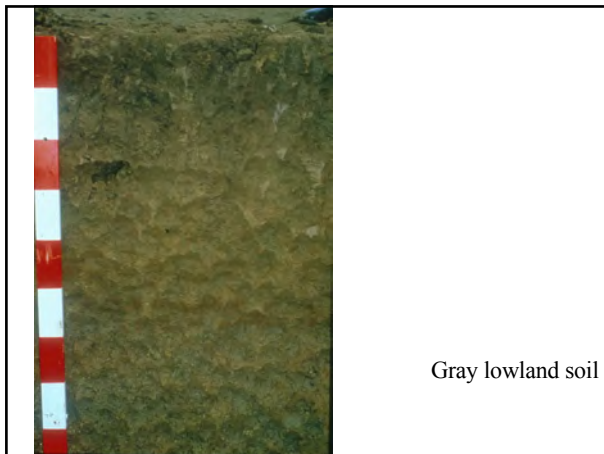
## Other soils in Hokkaido

- Immature volcanic soils
- Podsoles
- Dark red soil
- Brown forest soil
- Lowland soil
- Peat soil









Sarobetsu mire



Mt. Rishiri-Fuji beyond the sea



Kushiro mire from Hosooka observatory



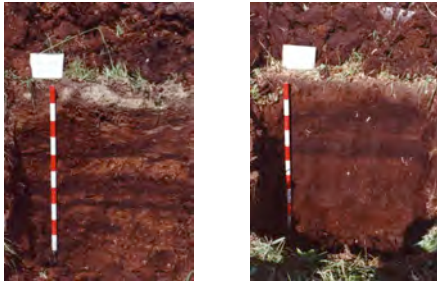
Kiritappu mire from Biwase observatory



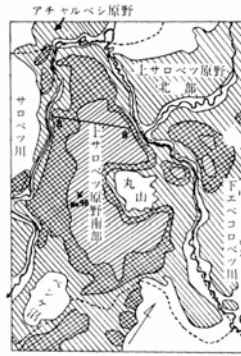
Oikamanai mire in Tokachi



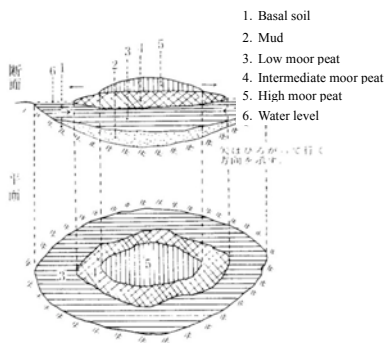
Horokayanto mire in Tokachi



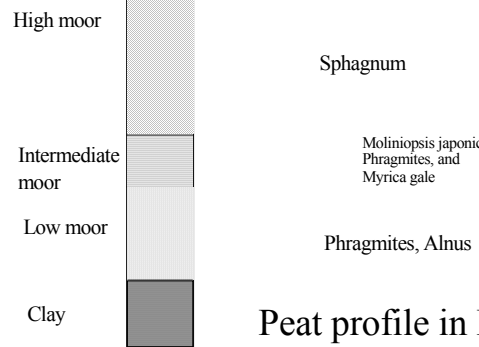
High moor and low moor profiles  
(both in grassland)



Distribution of high, intermediate, and low moor in Sarobetsu mire



Formation of peatland



Peat profile in Bibai wetland



エゾイソツツジ  
*Ledum palustre*  
*ssp. diversipilosum*

ヤチヤナギ *Myrica gale*  
ガンコウラン *Empetraceae*  
ヒメシヤクナゲ  
*Andromeda polifolia*

Plants in Sarobetsu mire



ショウジョウバカマとワタスゲ  
*Heloniopsis orientalis* and *Eriophorum vaginatum* L.



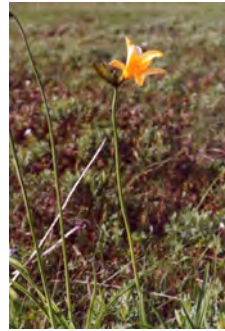
ツルコケモモ *Oxycoccus quadripetalus*  
ガンコウラン *Empetrum nigrum* var. *japonicum*



ヤチヤナギ *Myrica gale*  
キスゲ *Hemerocalis flava* var. *yezoensis*



ワタスゲ *Eriophorum*  
*vaginatum* L.



キスゲ *Hemerocalis flava* var. *yezoensis*



Lowpeat profile in Mukawa



Drying excavated peat for  
agricultural use



Bibai mire

### Bibai mire



### Peatland plants



ヤチヤナギ *Myrica gale*



ヤマウルシ *Rhus trichocarpa*



チマキザサ  
*Sasa palmata*

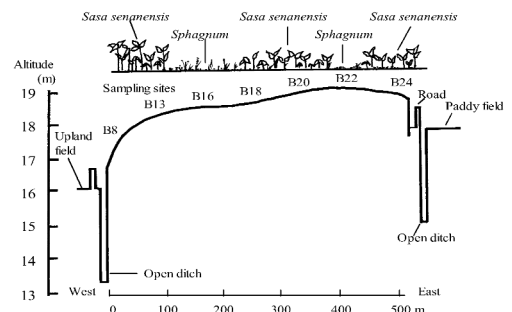


スゲ  
*Carex*

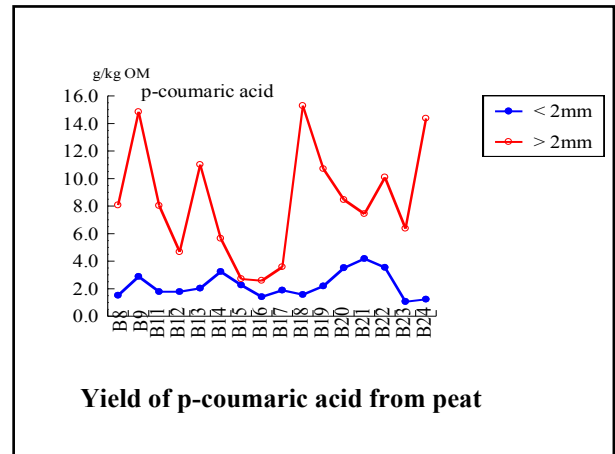
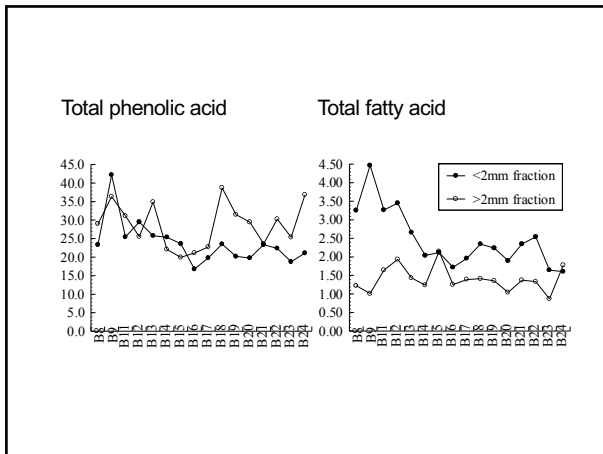
### Peatland plants (*Sphagnum*)



Peat profile in Bibai mire (turned to bush due to lowering of ground water level)



Transect of Bibai mire



### Summary

- Volcanic ash in Tokachi records the life of people for more than 20,000 years.
- Hills in Kamikawa area are beautiful, but the agricultural practice is difficult due to land shapes and heavy clay soils. Mud flow also damaged the land.
- Major soils in Hokkaido are characterized by three types of special problem soils.
- Wetlands in Hokkaido is a treasure box for wild lives, but the area is decreasing.