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Future concerns about rice production in relation to water

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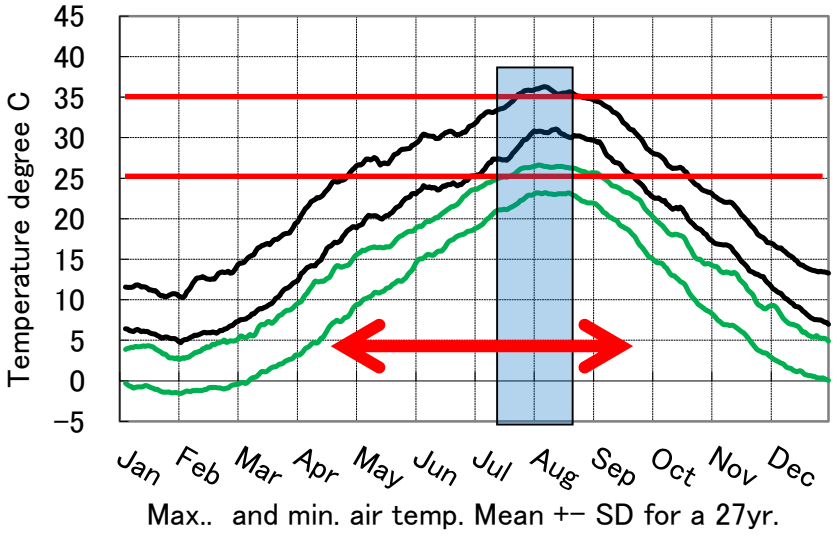
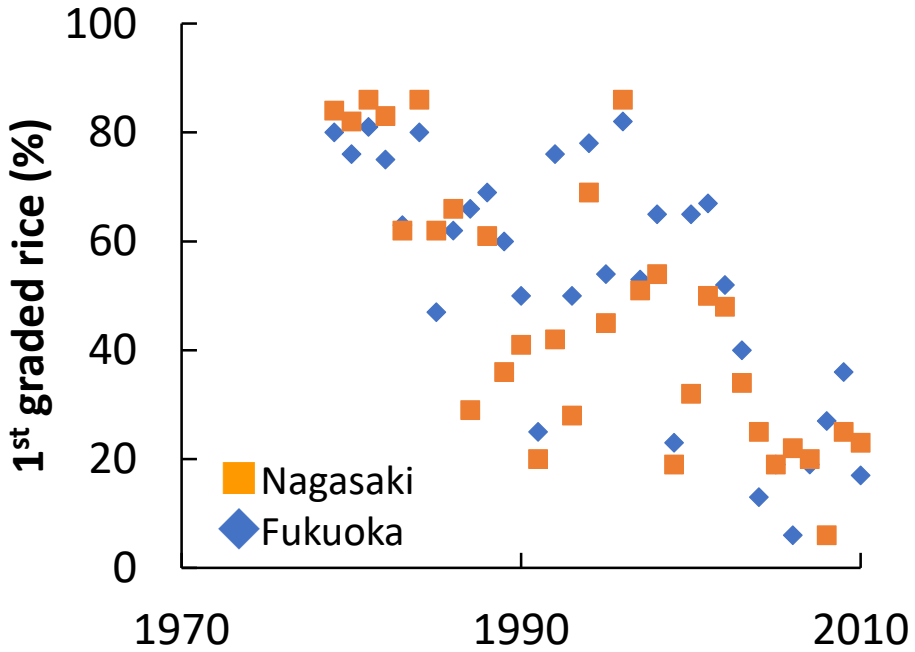
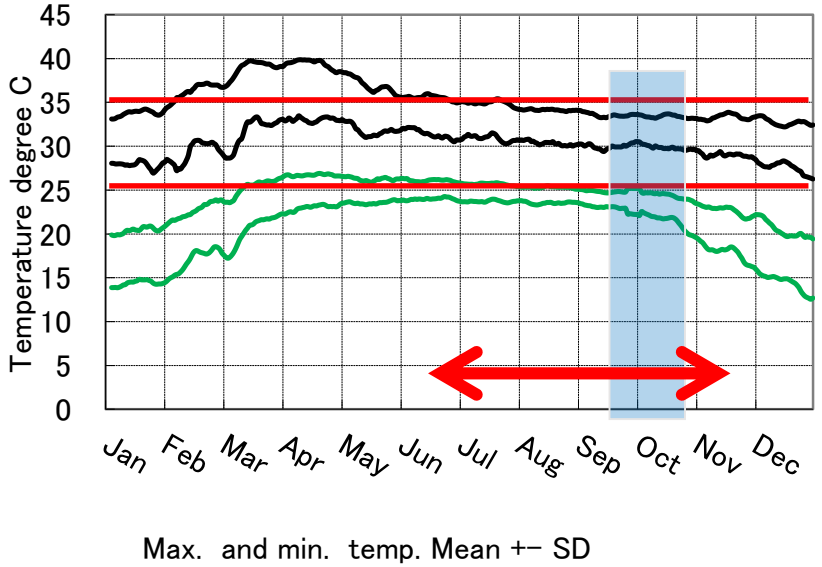
Global warming impacts on rice production

In Japan, decrease of 1st graded rice percentage has remarkable occurred due to global warming.
Temperature in the major rice production season in Japan is not necessarily lower than that in Southeast Asia.





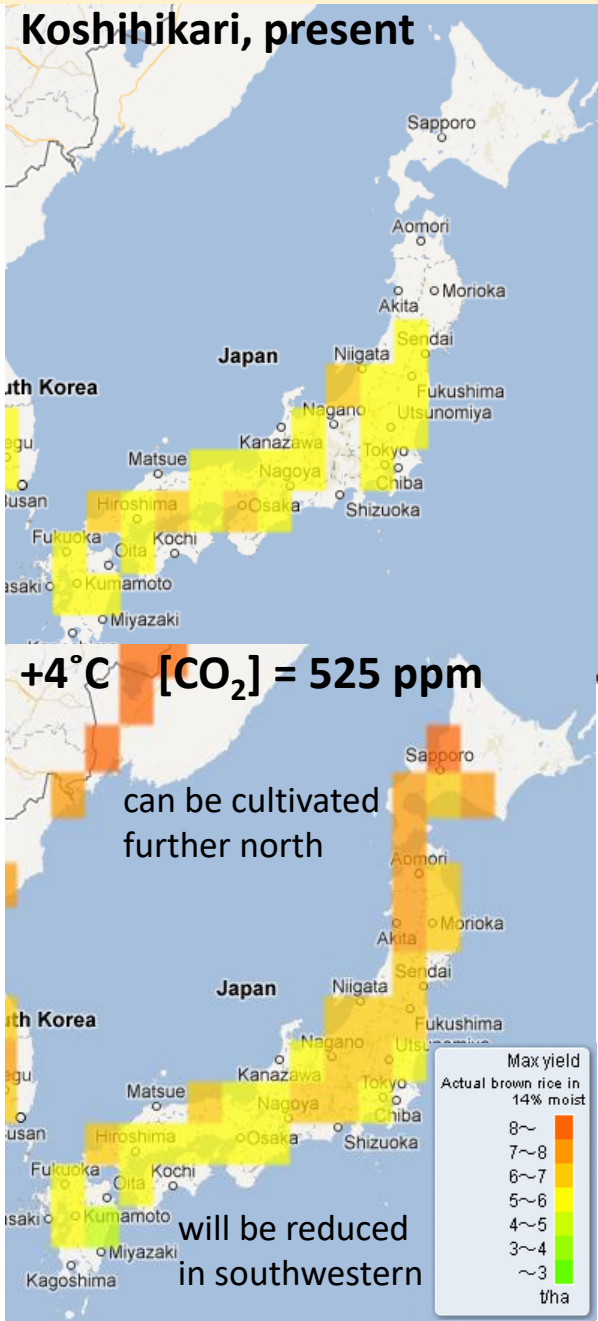


Global warming impacts on rice production

The simulation study also suggested that the rice productivity in southwestern Japan will be reduced.
No breakthrough method has been found to break this simulated results.
Only the effect of a few ˚C difference is quite difficult to experimentally clarify.
Counter measures of late-planting, fertilizer treatment, water management and so on are tested besides breeding of new varieties.

The global warming is the common issue in rice production in Asia.

Adaptation of crop management is firstly required.
However, water management which is one of the most important management in rice production has not been well investigated under future climate condition.

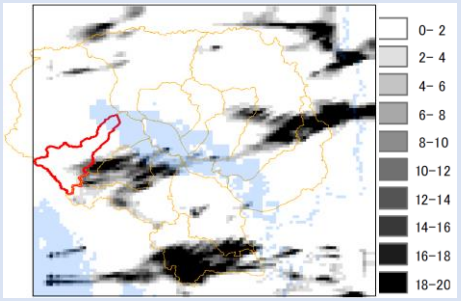


Climate (precipitation) change impacts on rice production

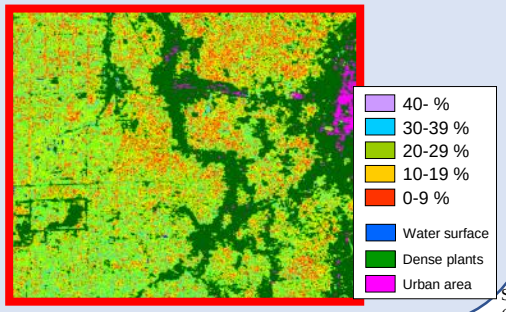
Combined crop simulation model with hydrological model

Water circulation

Rain fall



Soil moisture



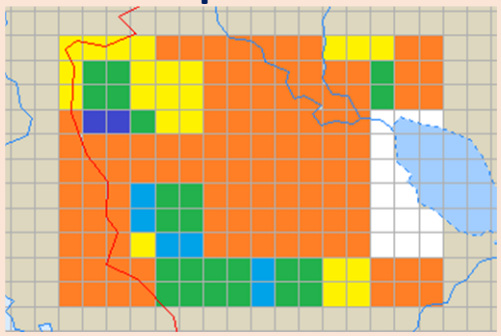
Irrigation

Management

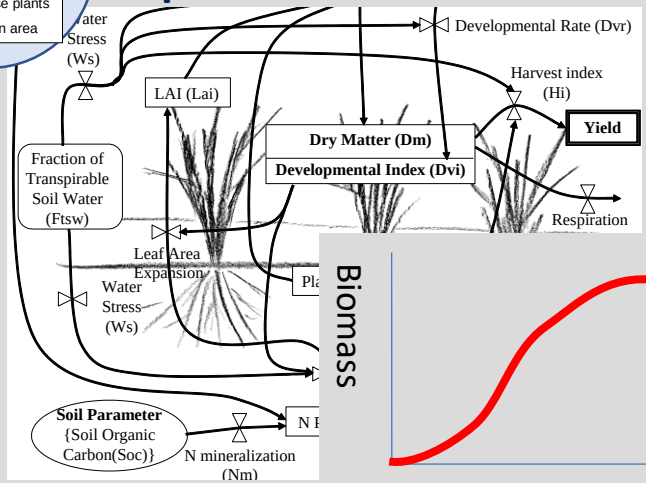
Leaf area index

Crop (fertilizer, planting)

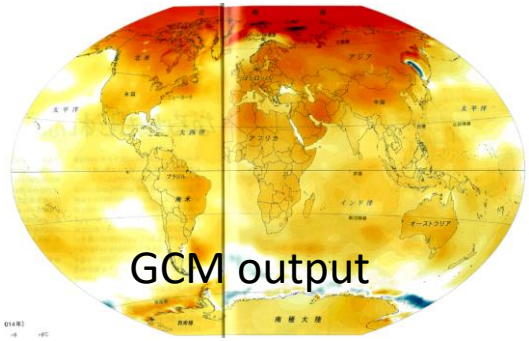
Evaluation in the present



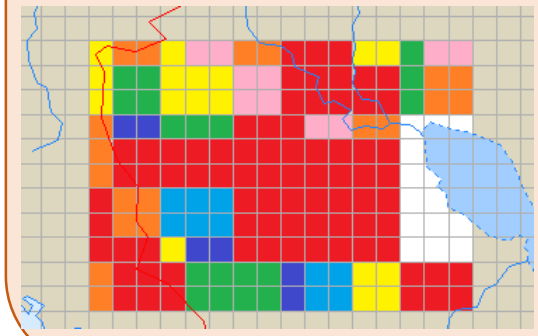
Crop simulation model



Weather data
Soil moisture



Prediction for the future



Climate (precipitation) change impacts on rice production

The combined model was applied for the Musi river basin in Indonesia.

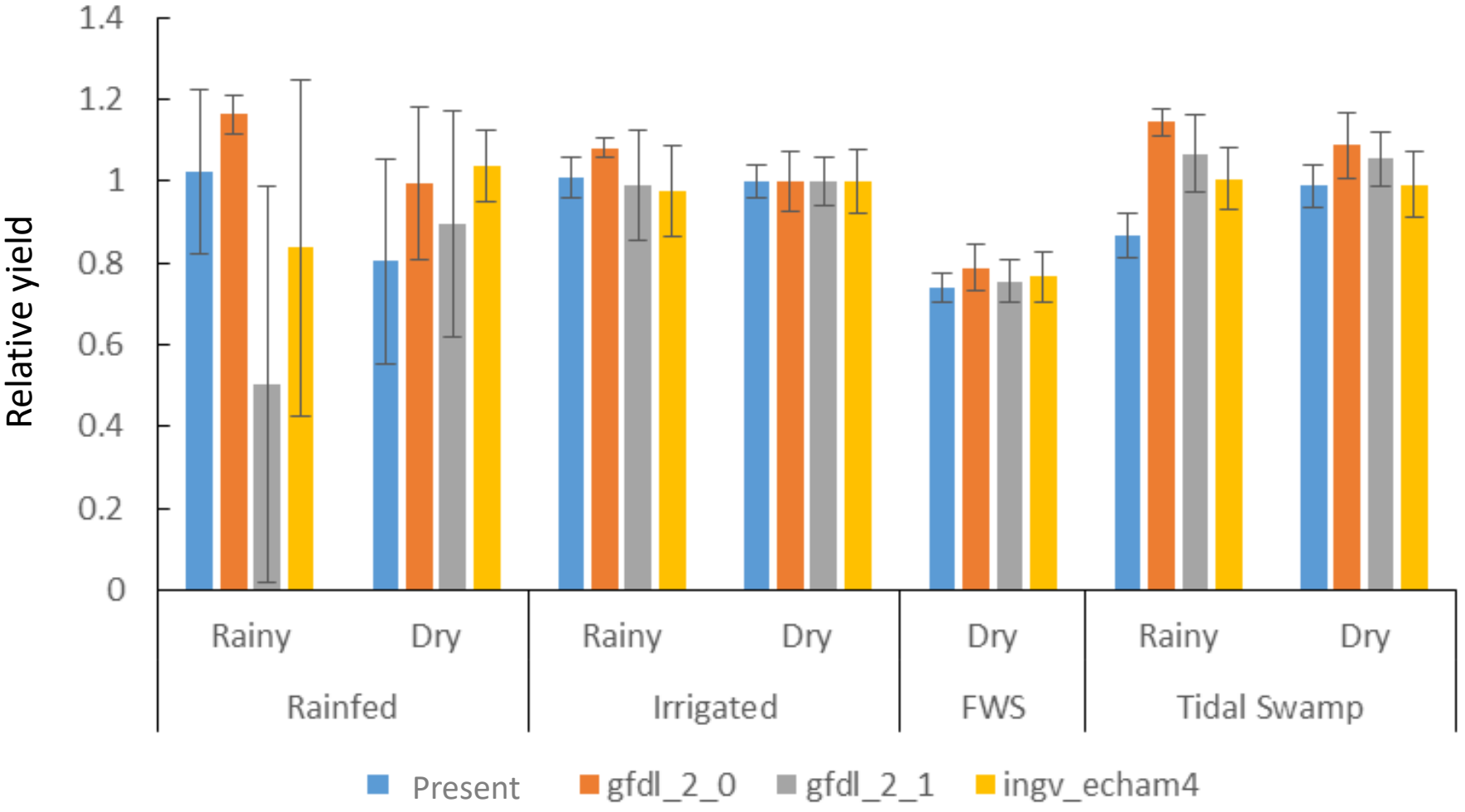
Rice production is divided into 4 ecotypes:

- Rainfed:
  without irrigation facility
  (depending on rainfall)
  106,000ha 1 or 2 crops/year
- Irrigated:
  with irrigation facility
  110,000ha 2crops/year
- Tidal swamp:
  utilize tide for irrigation
  240,000ha 1 or 2 crops/year
- Fresh water swamp:
  utilize recession water
  350,000ha 1 crop/year

Climate (precipitation) change impacts on rice production

Simulation was conducted after calibration based on farmers' fields investigation. Yield was simulated for future climate (2050-2065) and compared against those for present climate (1985-2012).

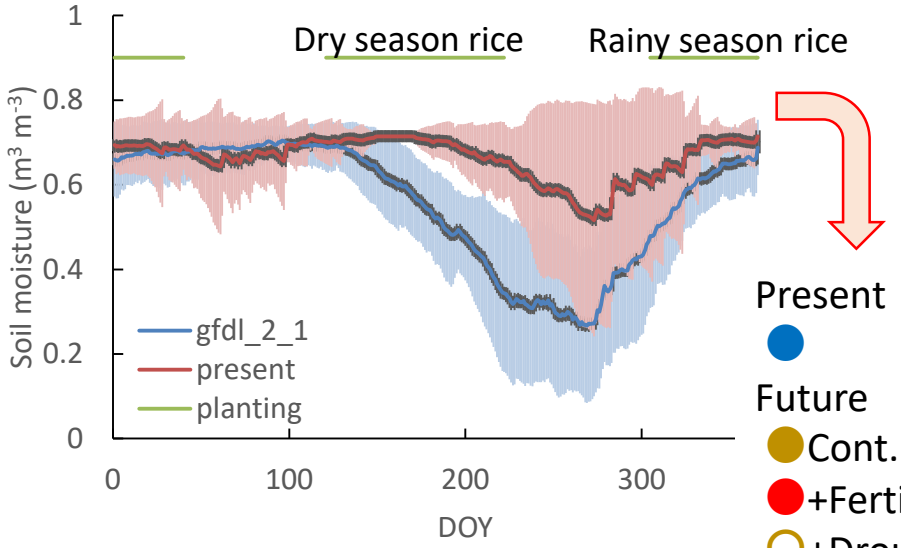
The yield was compared with relative yield (yield relative to that obtained in irrigated ecotype in dry season.



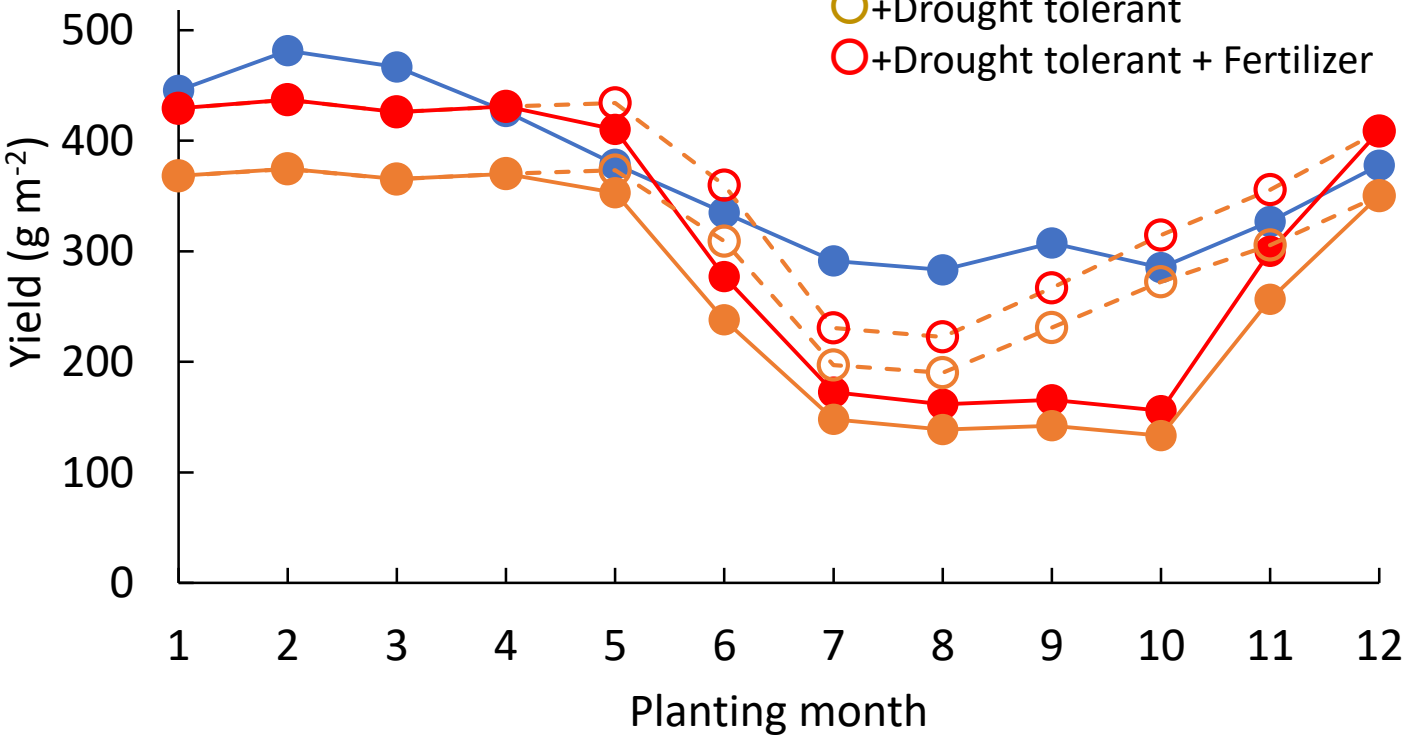
Climate (precipitation) change impacts on rice production

The large yield reduction of rainfed rice in rainy season under GFDL 2.1 scenario was due to lower soil moisture content during the beginning of rainy season rice planting.

The reduction could be alleviated by adjustment of planting month or development of drought tolerant variety with fertilizer enhancement.

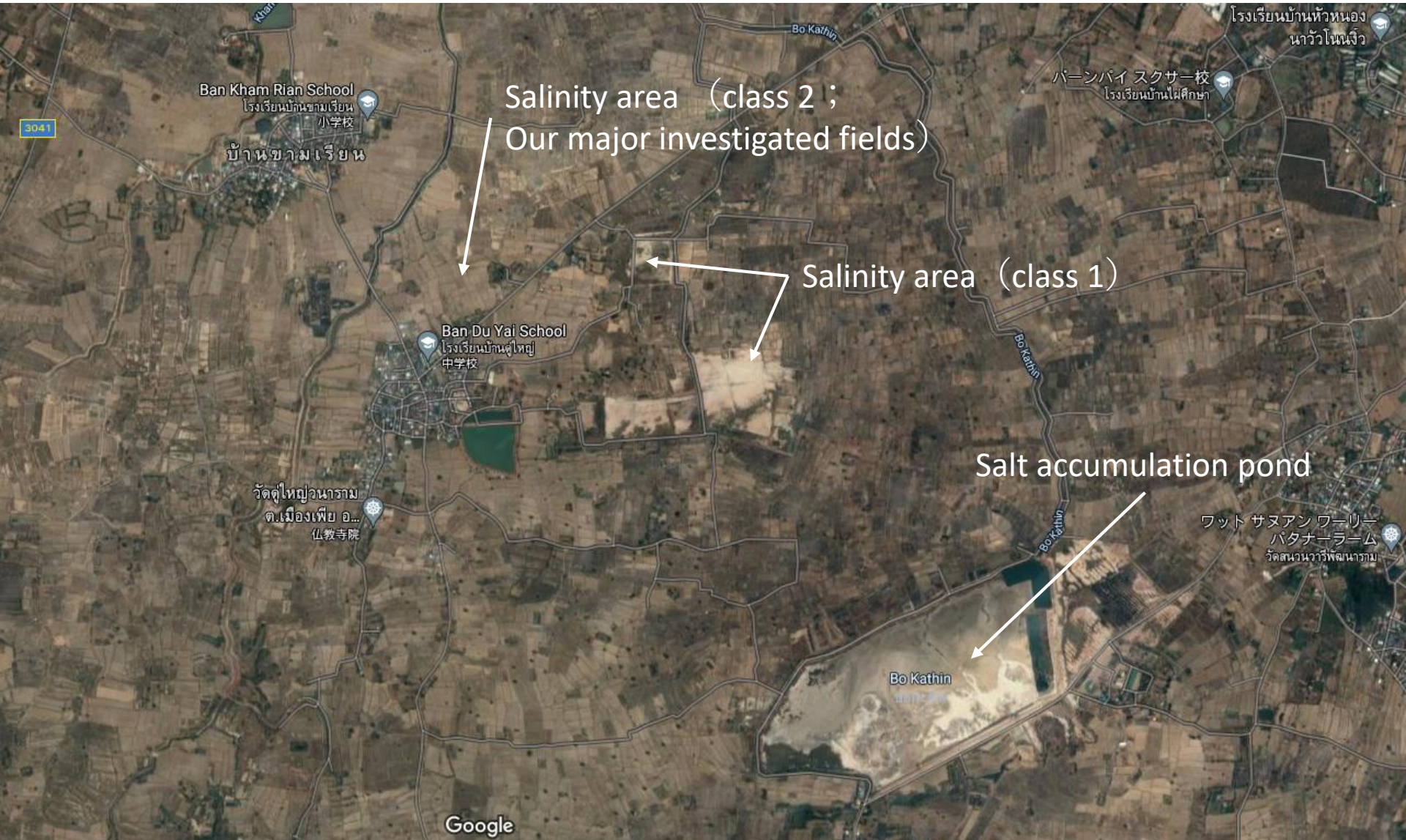


Impact assessment



Salinity problem in relation to water

One of our activities evaluates rice productivity in saline affected area in northeast Thailand.
Salinity levels are classified into 5 classes in Thailand:
1: “very severely (salt crust >50%)”; 2: “severely (salt crust 10-50%)”……5: “no salinity”



Salinity problem in relation to water

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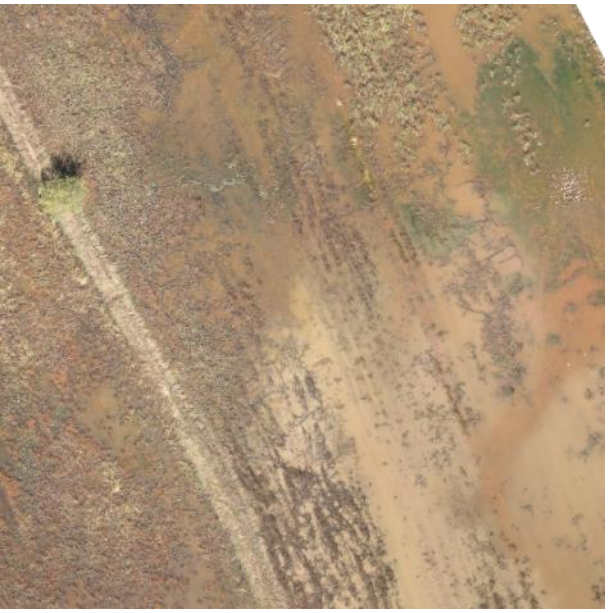

Salinity problem in relation to water

We are now accessing the salinity damage on rice production.
The salinity problem is mainly caused with rock salt under the ground in the area.
However, deforestation is thought to be involved in the background: deforestation increased the ground water level in dry season which enhanced salt accumulation at the soil surface.

Forecasts and countermeasures are necessary beyond decades in relation to water.