

# A method for automatic creation of a vegetation map using high-resolution aerial photographs of unmanned aerial vehicles



*Masatoshi DENDA • Yuichi KAYABA*

*River restoration team, Water environment group, Public Works Research Institutes*

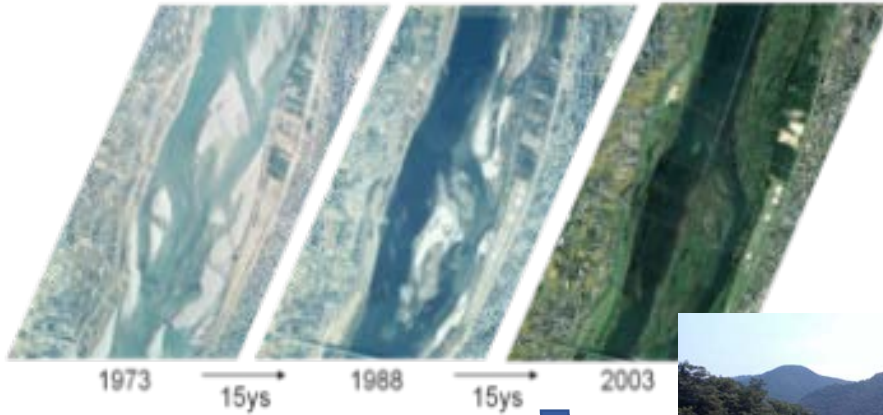
*Ministry of Infrastructures, Transport and Tourism, Japan government*

<http://www.pwri.go.jp/team/rrt/index.html>, [denda@pwri.go.jp](mailto:denda@pwri.go.jp)

# Introduction : Woodland Overgrowth

- Wood overgrowth in river channels degrades the discharge capacity and biodiversity; thus, it is an important river management issue in Japan.
- Many researchers and river managers have pointed out the degradation of riverbeds and reduce of flood disturbance due to gravel pits.
- However, there have been few studies on using ecological modeling to quantify the mechanism. Therefore, our aim was to conduct quantitative research on the mechanism and discuss operation methods to address overgrowth.

## Wood overgrowth

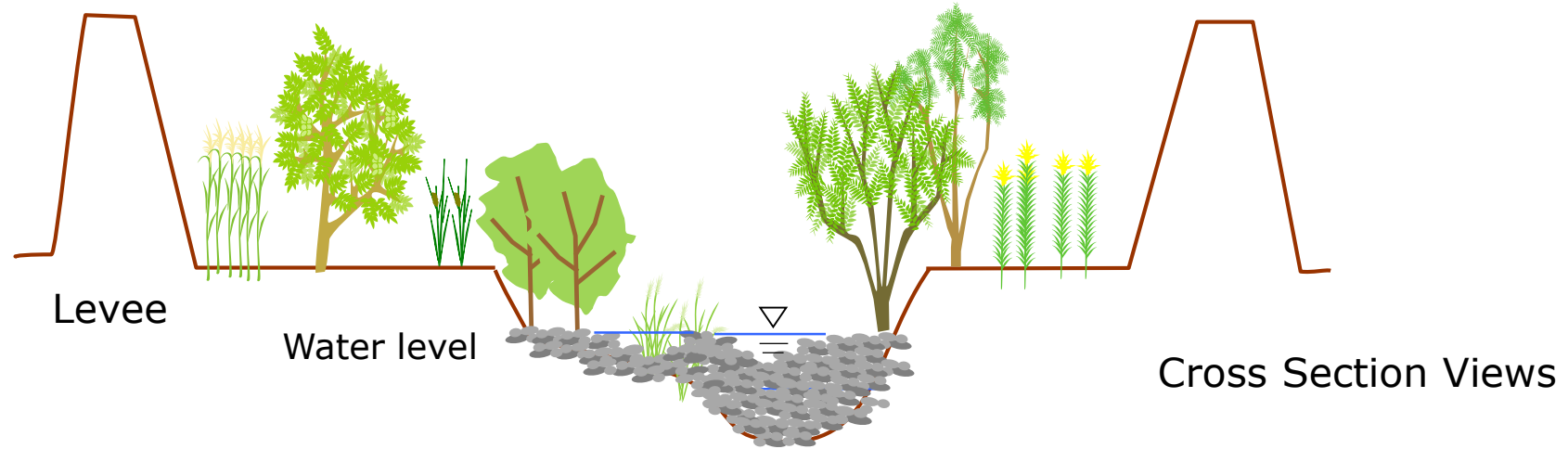


## flood-flow capacity

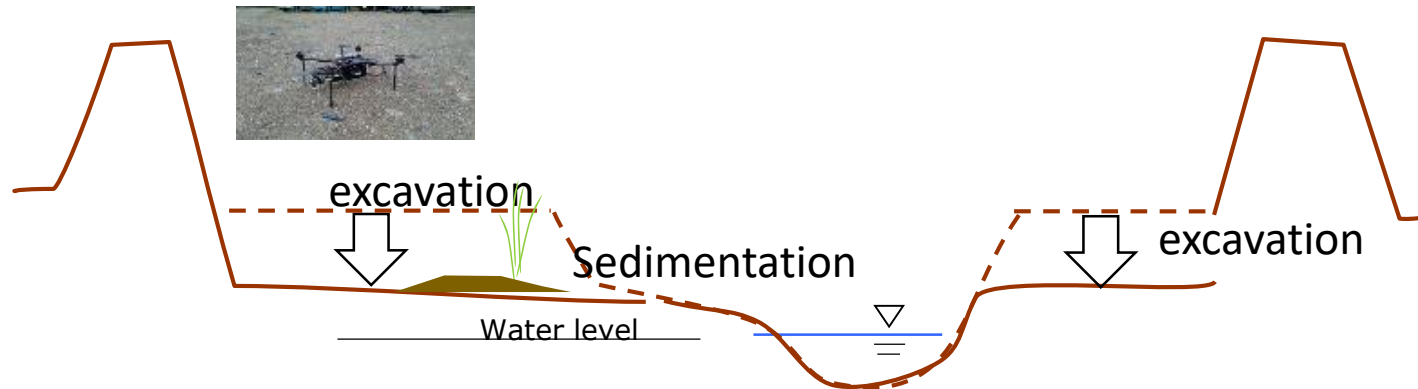


# Purpose : developments of automatically monitoring method

## ■Mechanism of Woodland overgrowth



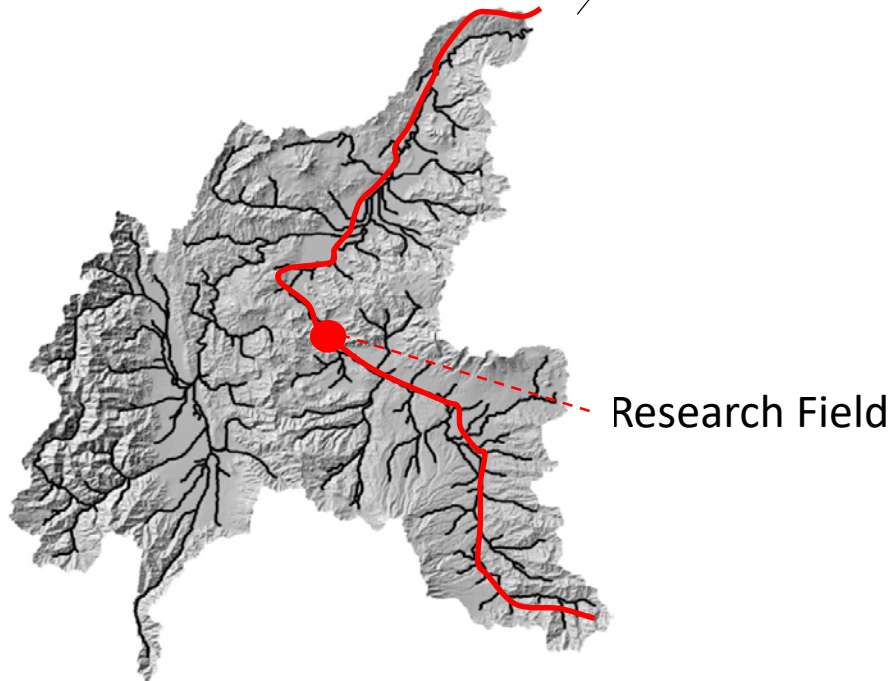
## ■River Restoration method : channel excavation



First step goal :

Development of automatic creation of a vegetation map using high-resolution aerial photographs of unmanned aerial vehicles .

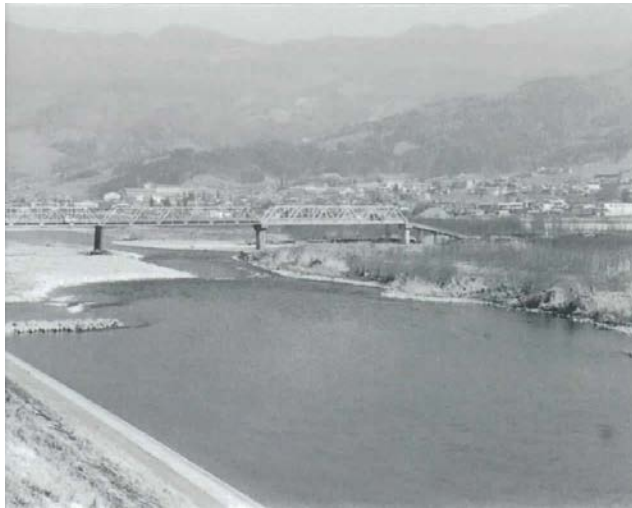
# Method: Overview of the Chikuma river



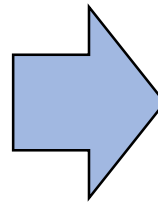
slope of the river bed : 1/200  
Average depth : 0.75m

# River ecosystem change in middle reach of the Chikuma river

In the past river space in middle reach of the Chikuma river has good habitat condition such as sand and gravel riverbed spread along various fluvial condition. And pools, riffles, and ecotones formed along the river, the condition supplied to the good habitat for the aquatic biota.



In 1964  
Water surface wide are wide, sand and gravel river land spread.  
In the sand bar, low trees such as willows growth.



In 2004  
Sand bar divided the fluvial area,  
locust growth in sand bar.

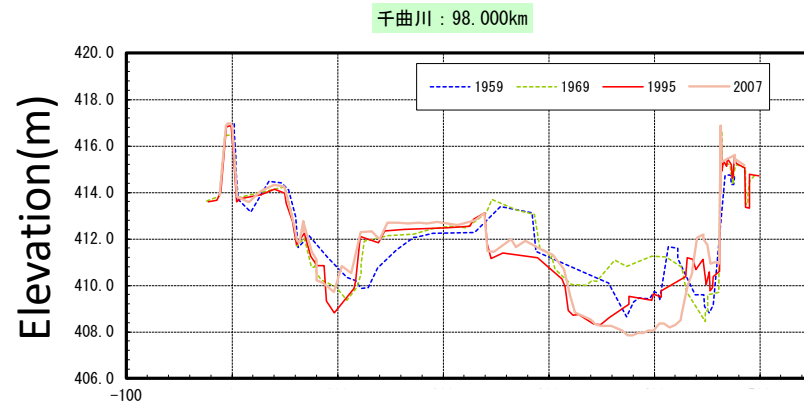
And, degradations of sand and gravel river bed and ecotone damaged the habitat such as little tern.

※Committee on planning of conservation and restoration on sand and gravel river land in middle reach of the Chikuma river

# Typical pattern on bio-diversity degradation in the Chikuma river



Gravel pit



Cross Section Distance(m)

Degradation of disturbances due to floods      Degradation of riverbed

Decrease of habitat of characteristic species on river land

Growth land spread of Invaded species



wormwood(*Artemisia capillaris* Thunb)



little tern

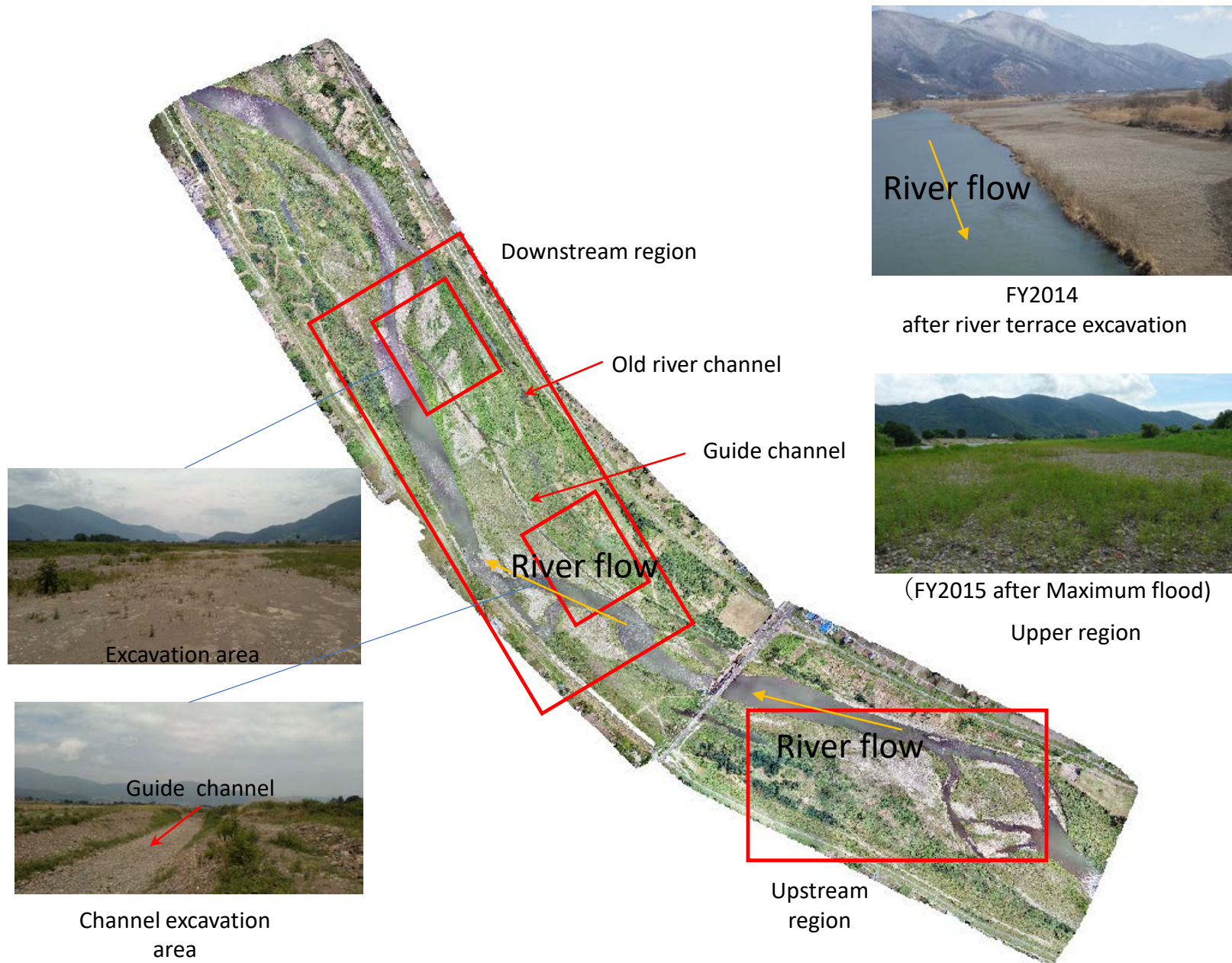


Over growth of wood land due to locust



Growth of bur-cucumber

# Overview of Restoration projects in the Chikuma river



# Results of Restoration projects in the Chikuma river

## Creation of gravel bed conditions



After river restoration project in FY 2016



After Maximum flood in FY 2016



After Maximum flood in FY 2017

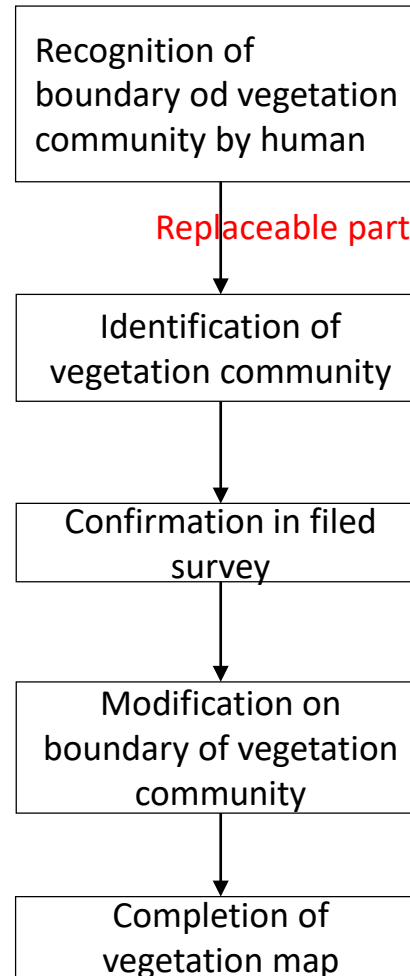




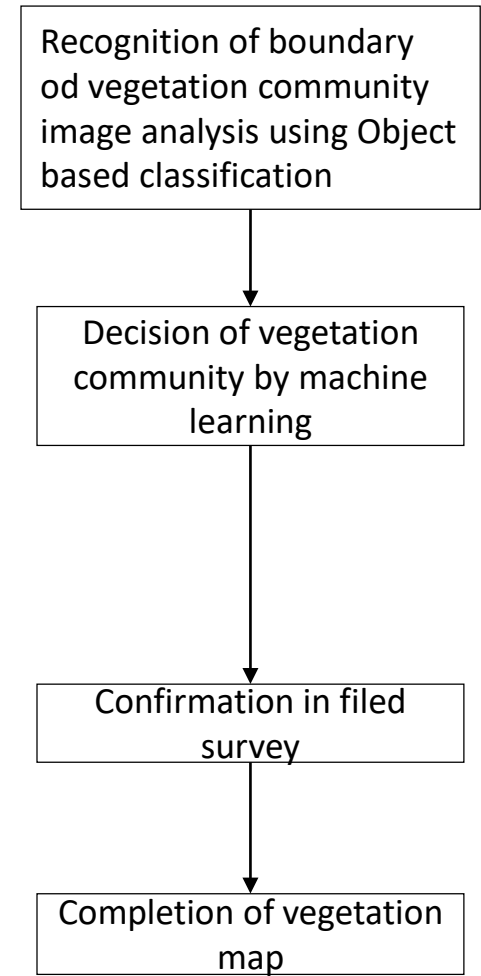
# Flow of vegetation map creation and Replaceable part by machine learning



## Vegetation Map



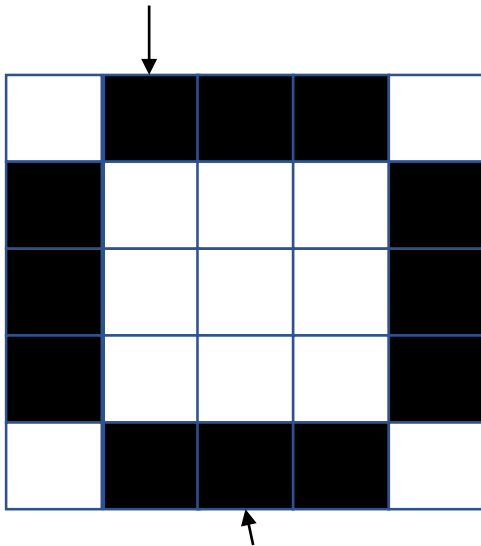
## Machine Learning



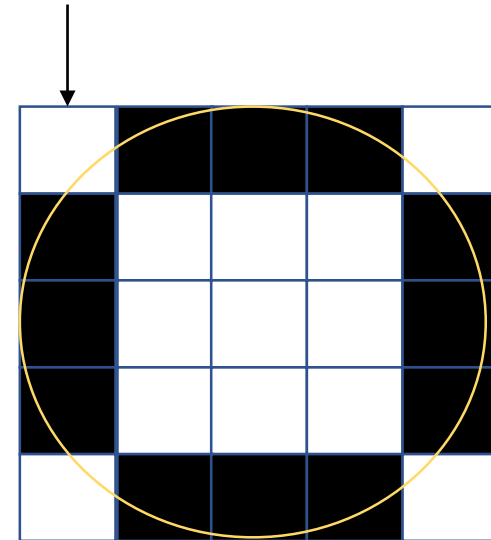
## ■ Overview of Object Based Classification

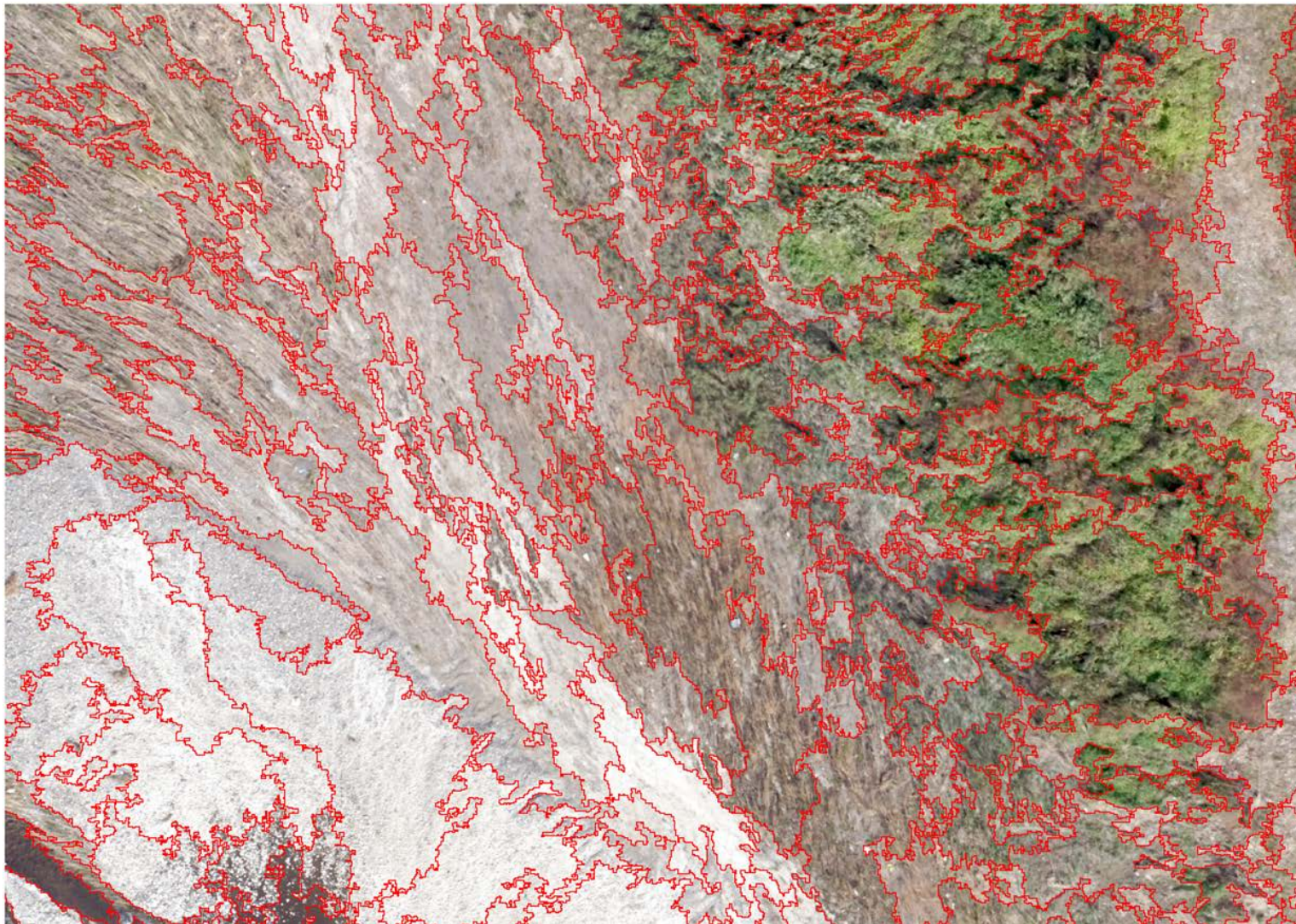
Object-oriented image classification involves identification of image objects, or segments, that are spatially contiguous pixels of similar texture, color, and tone (Green and Congalton, 2012)

One pixel has enough data for recognize boundary of vegetation community



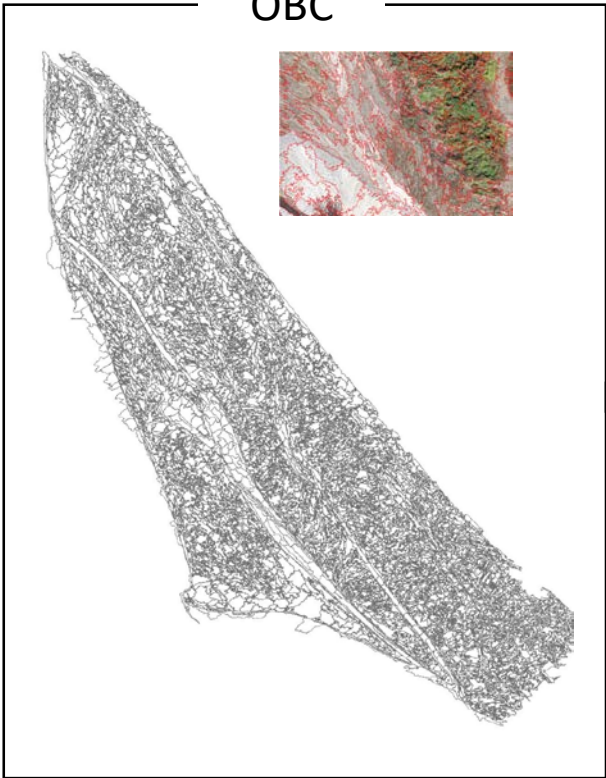
Recognition by Similar pixels sounding area



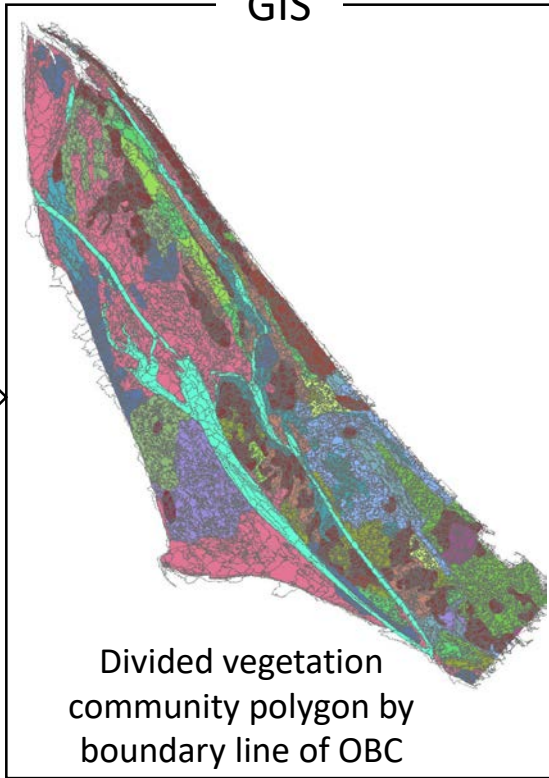


# Decipher of Vegetation community Using decision tree

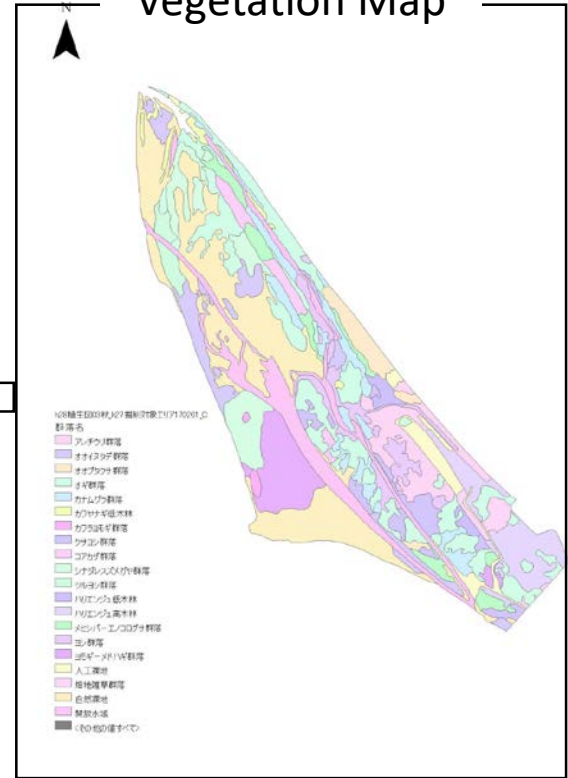
OBC



GIS



Vegetation Map



- Information on image
  - Brightness
  - R,G,B average
  - R,G,B standard deviation
- Information on shape and morphology
  - Area
  - Boundary length
  - DEM(Digital elevation model)
  - DSM(Digital Surface model)

Divided vegetation community polygon by boundary line of OBC

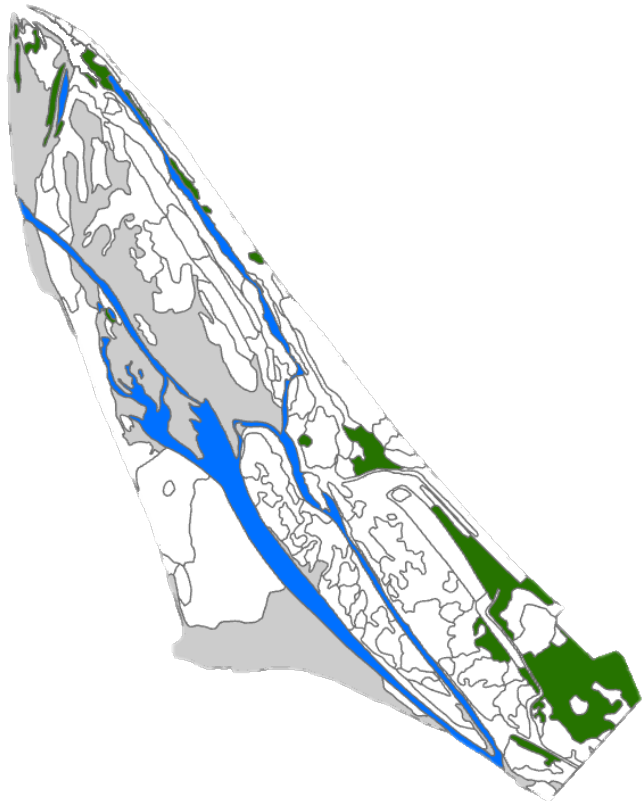
- Total Number : 6128 polygons
  - Training data : 4352
  - Prediction data : 1866

Decision tree

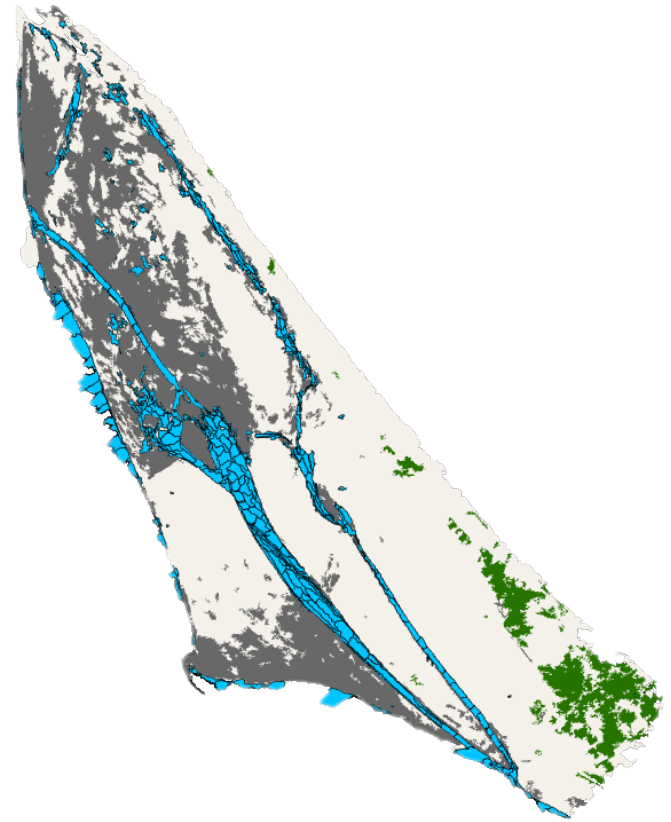
•Vegetation community name



# A Result of automatically creation vegetation map using object-based classification



Human creation vegetation map



Automatically creation vegetation map

## Legend

- Woodland area
- Water area
- Gravel bed

Automatically creation vegetation map reconstructed the spatial distributing character of sand-bar landscape

Thank you for your attention !

