

# Current Situation and Future Perspective on Radioactive Contamination in Fukushima Evacuation Zone

- A report from Yamakiya -

## Team Chiba University

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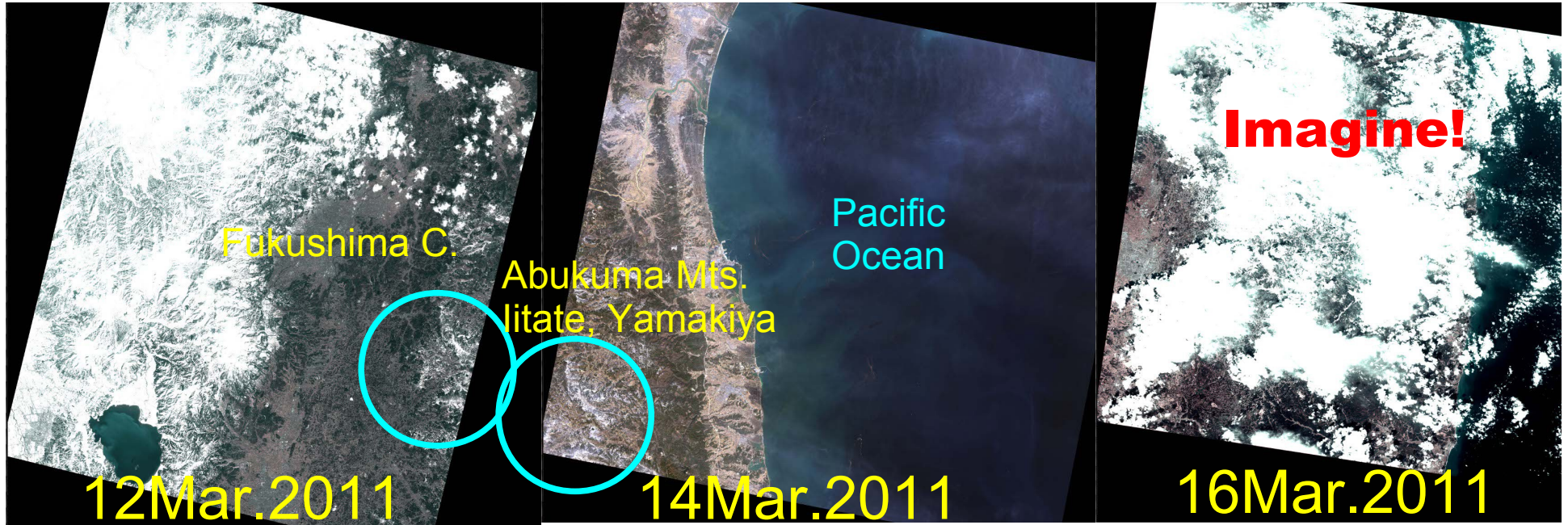
Graduate School of Horticulture, Chiba University

Graduate School of Horticulture, Chiba University

Graduate School of Pharmaceutical Sciences

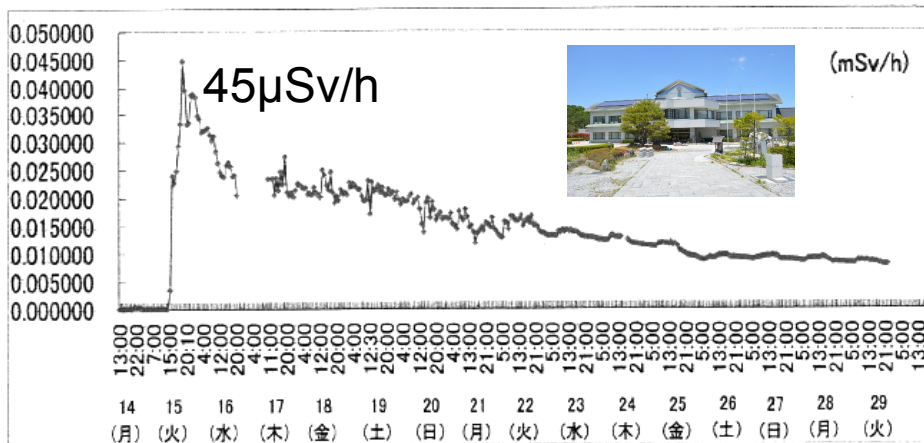
Graduate School of Horticulture, Chiba University

# Look back to 3.11.2011



ALOS/AVNIR2 images around Abukuma Mountains after the great earthquake  
**15<sup>th</sup> evening, people in Abukuma changed to Refugee from Supporter.**

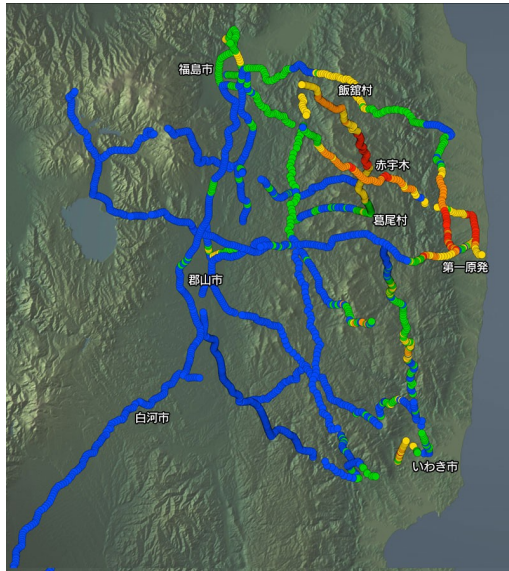
Rain changed to snow in the evening of 15<sup>th</sup>, March. It contained much amount of radioactive materials.....



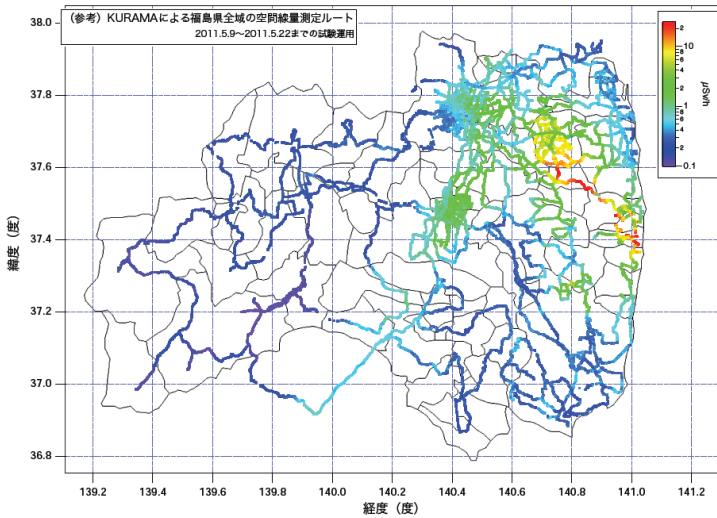
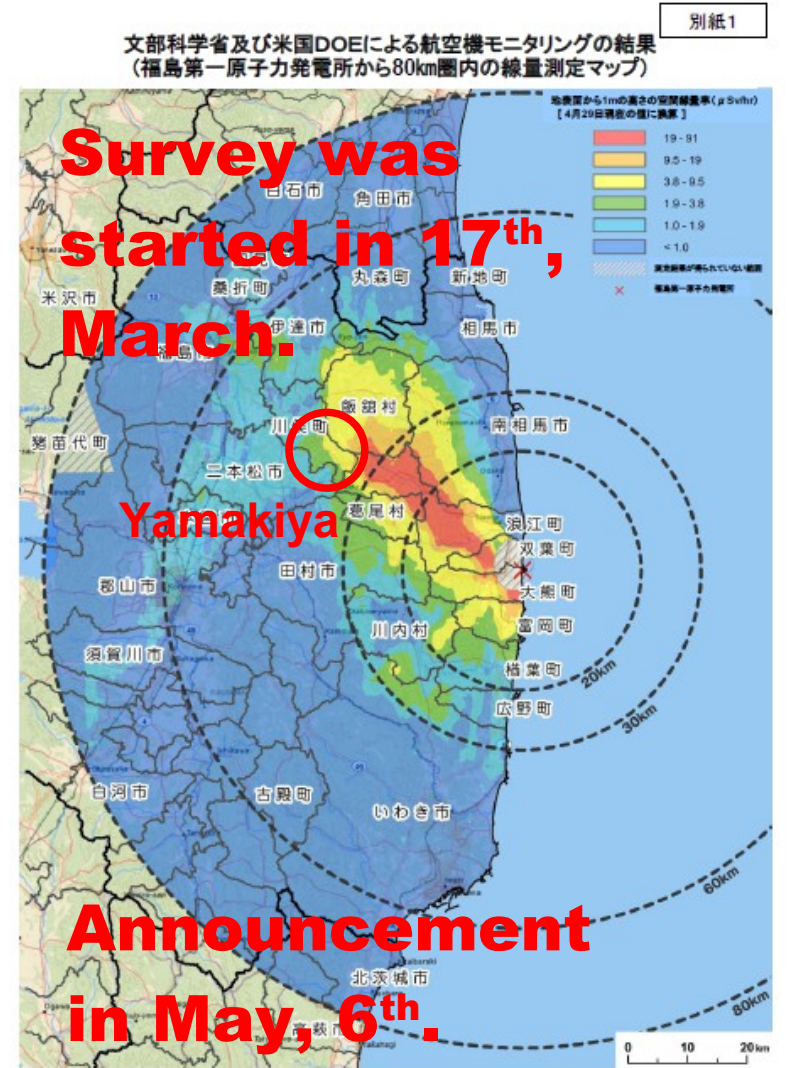
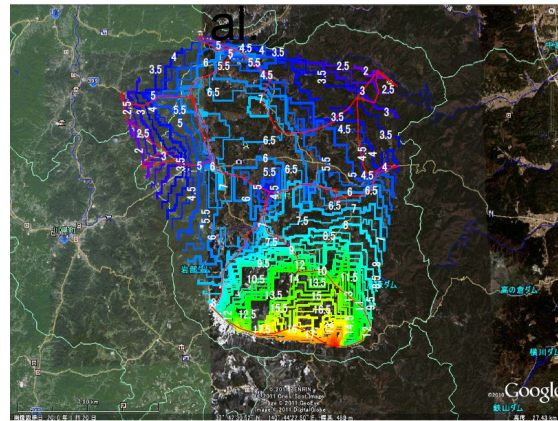
# Dose Rate Survey at Initial Stage



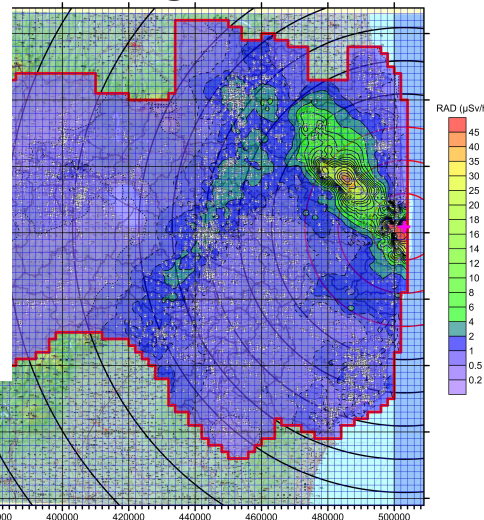
NNSA Aerial Measuring Systems (YouTube)



S.Kimura **March**  
T.Imanaka et



Fukushima Univ.



MEXT/Kyoto Univ.

**June**

データソース「福島県環境放射線モニタリングシステム」調査結果集 (2011.5.9~2011.5.22までの試験運用データ)  
調査経路: 福島県環境放射線モニタリングシステム調査結果集 (2011.5.9~2011.5.22までの試験運用データ)  
福島県環境放射線モニタリングシステム調査結果集 (2011.5.9~2011.5.22までの試験運用データ)  
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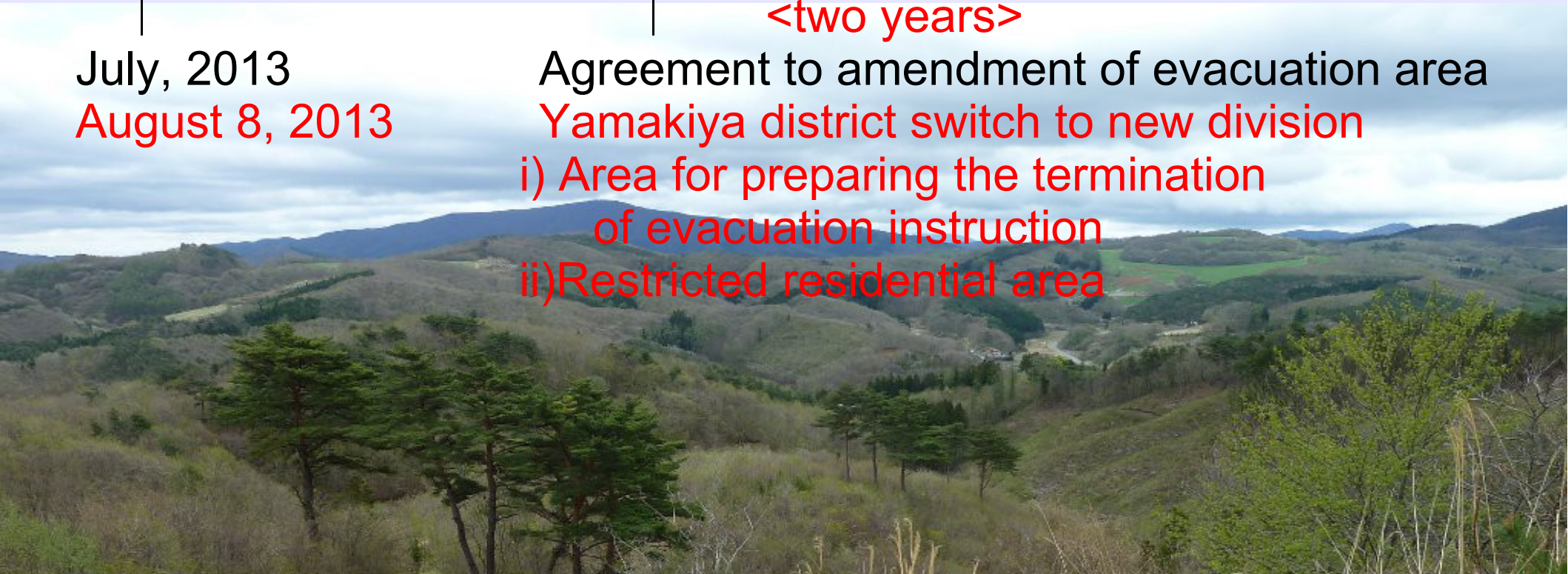
UTM-E (m)[WGS84, Zone-54]  
2.5 空間放射線量 (Height=1m)  
測定地点



DOE/MEXT

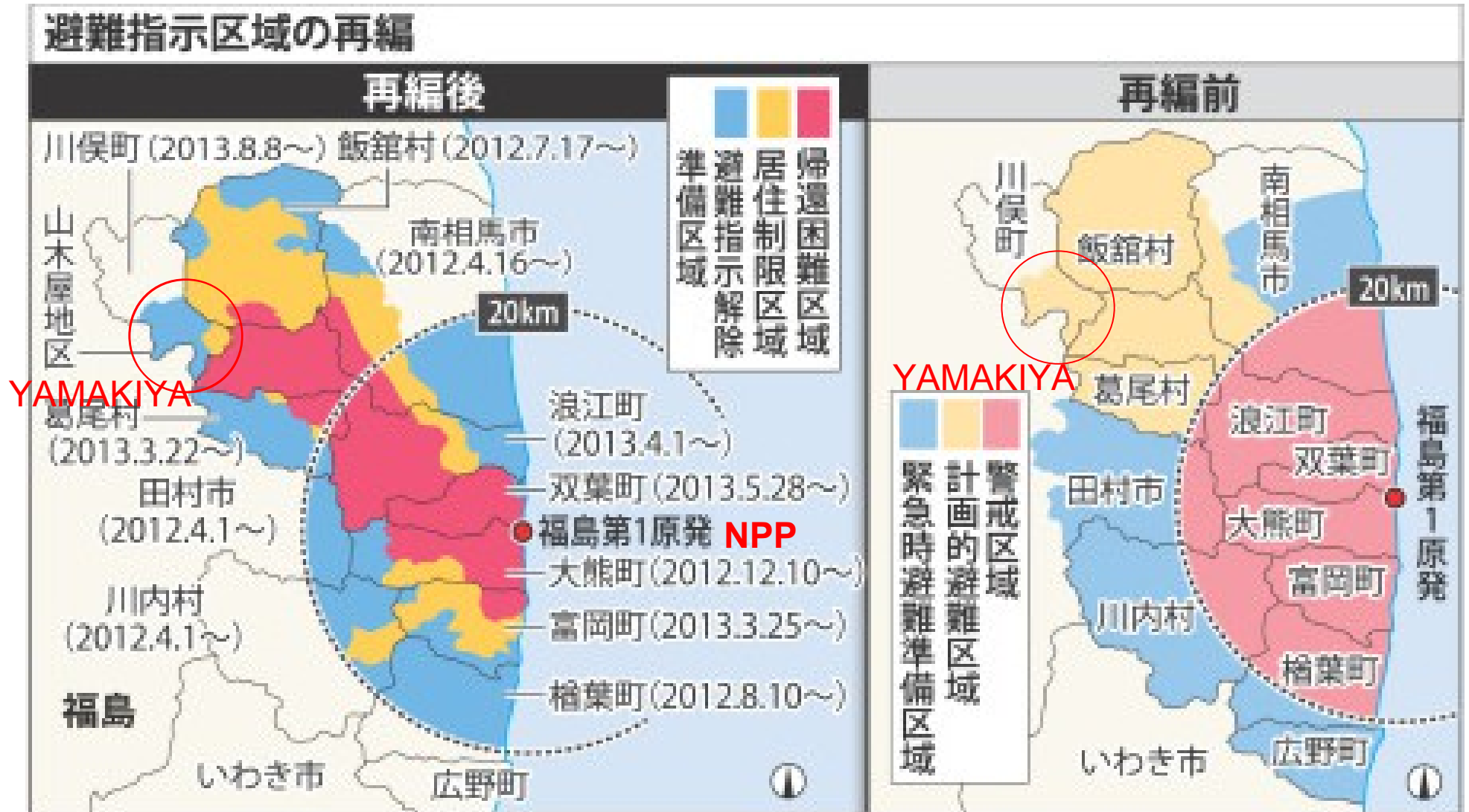
# Yamakiya district, Kawamata Town, Fukushima Prefecture

March 11, 2011	Great Earthquake
March 15, 2011	Major fallout in Abukuma area
	<b>&lt;one months&gt;</b>
April 11, 2011	Notice to forced evacuation
April 22, 2011	Assignment to planed evacuation area
	<b>&lt;two months&gt;</b>
June to July, 2011	Completion of evacuation
	<b>&lt;two years&gt;</b>
July, 2013	Agreement to amendment of evacuation area
<b>August 8, 2013</b>	<b>Yamakiya district switch to new division</b>
	<b>i) Area for preparing the termination of evacuation instruction</b>
	<b>ii)Restricted residential area</b>



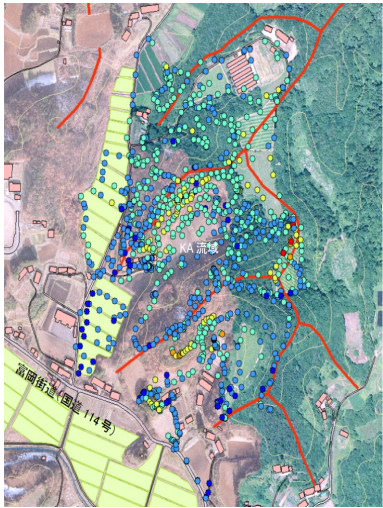
# Yamakiya district reorganized to new division from 8<sup>th</sup> August, 2013. Today!

- Area for preparing the termination of evacuation instruction (under 20mSv/y)
- Restricted residential area (over 20mSv/y)
- Area difficult to return (over 20mSv/h after five years)



# Team Chiba University Environmental Remediation and Reconstruction

- Radioactivity Monitoring
- Environmental Remediation
- Hydrological observation
- Market restration
- Search for new crops
- GIS
- Baiomass power generation
- • •



Yamakiya District

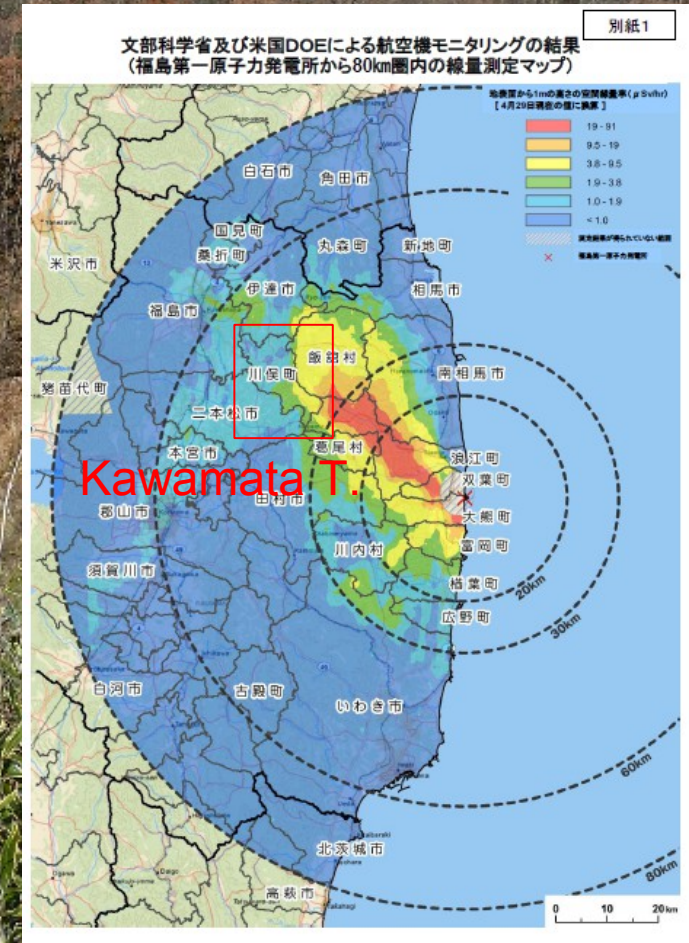
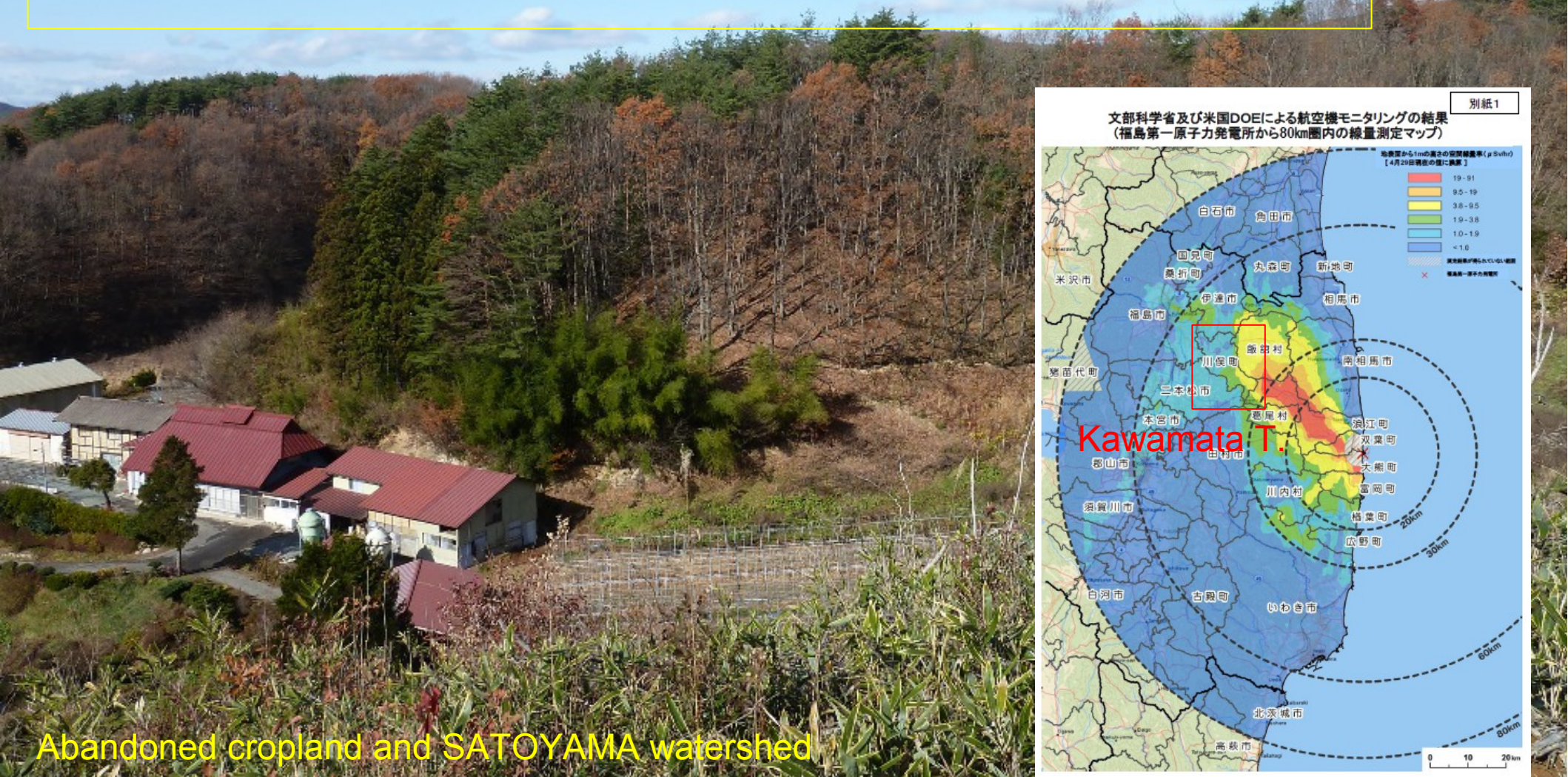


# Ideas of Geography – Spatial Scale -

Mesoscale (Prefecture scale)  $10^2\text{km}$

Village community scale  $10^1\text{km}$

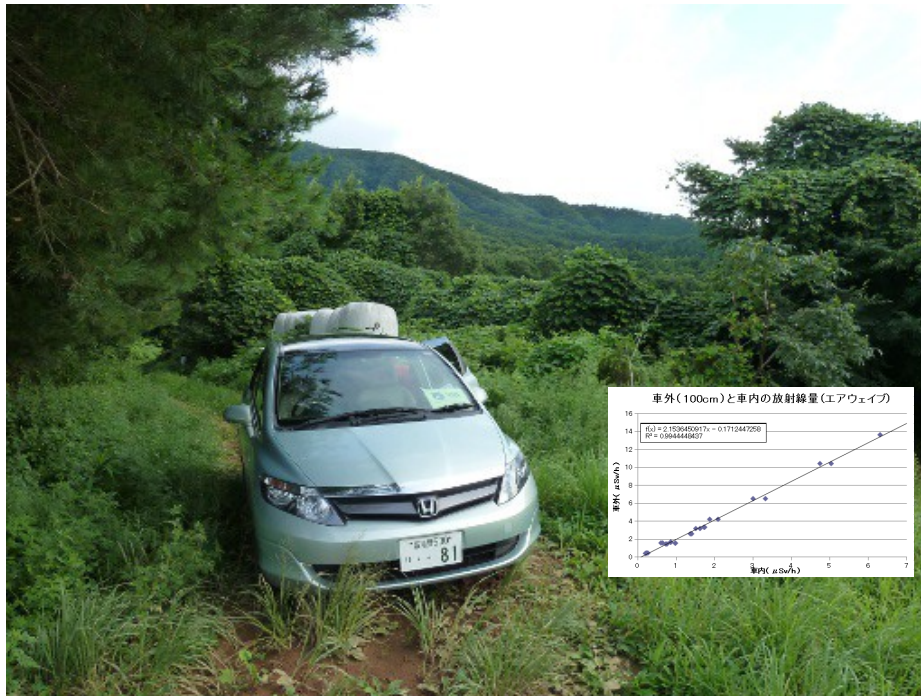
SATOYAMA watershed scale  $10^0\text{km}$



Abandoned cropland and SATOYAMA watershed

June to August in 2011  
**Dose Rate Survey**  
**By Motor Vehicle**

To get community scale  
dose rate distribution in  
**mountain area.**



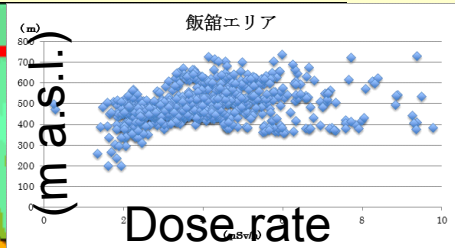
Gamma ray spectrometer, RT-30,  
synchronized with GPS

**Driving on the path  
through forest and  
fields**



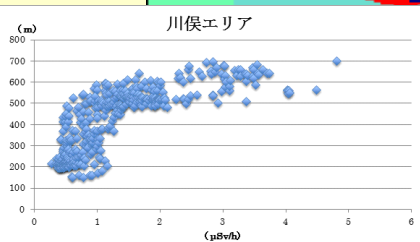
# Dose rate map around Iitate village and Kawamata Town

June & July, 2011



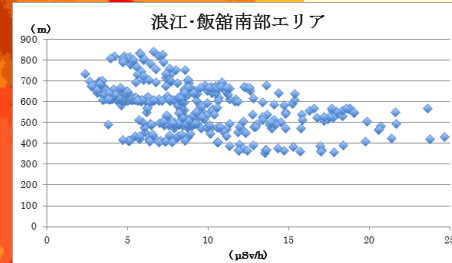
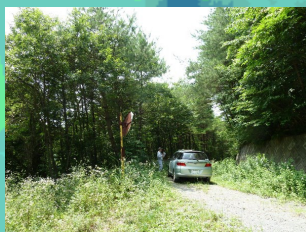
Kawamata T.

Iitate V.



空間線量率  
( $\mu\text{Sv/h}$ )

20 <	
15 - 20	
10 - 15	
7 - 10	
5 - 7	
3 - 5	
2 - 3	
1.5 - 2	
1 - 1.5	
< 1	

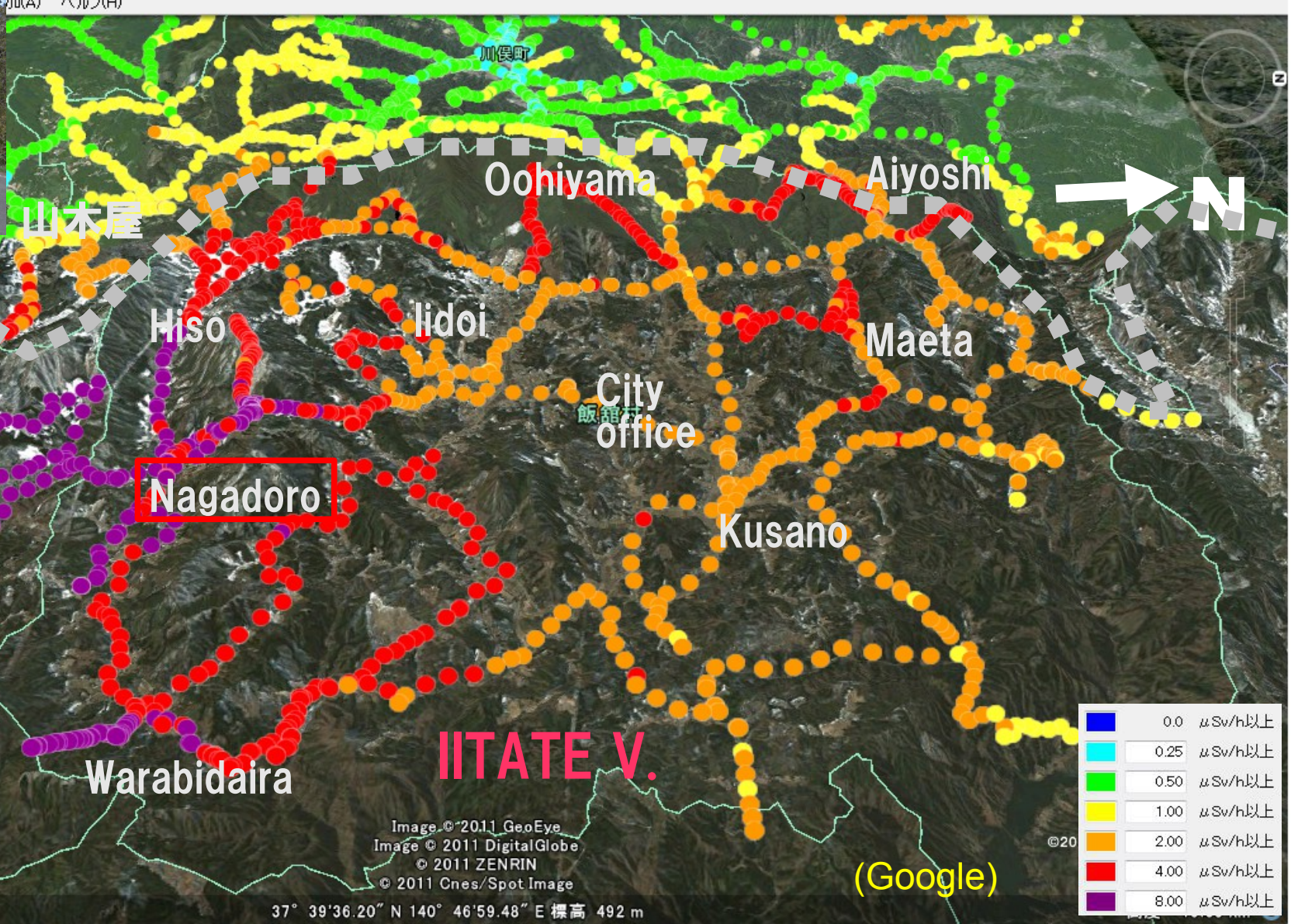


Namie T.

0 2 4 8 12 km

Dose Rate Survey: June to August in 2011. Back is 3<sup>rd</sup> Aerial Monitoring (July, 2011)





Need more detailed dose rate distribution map

# Walking Survey

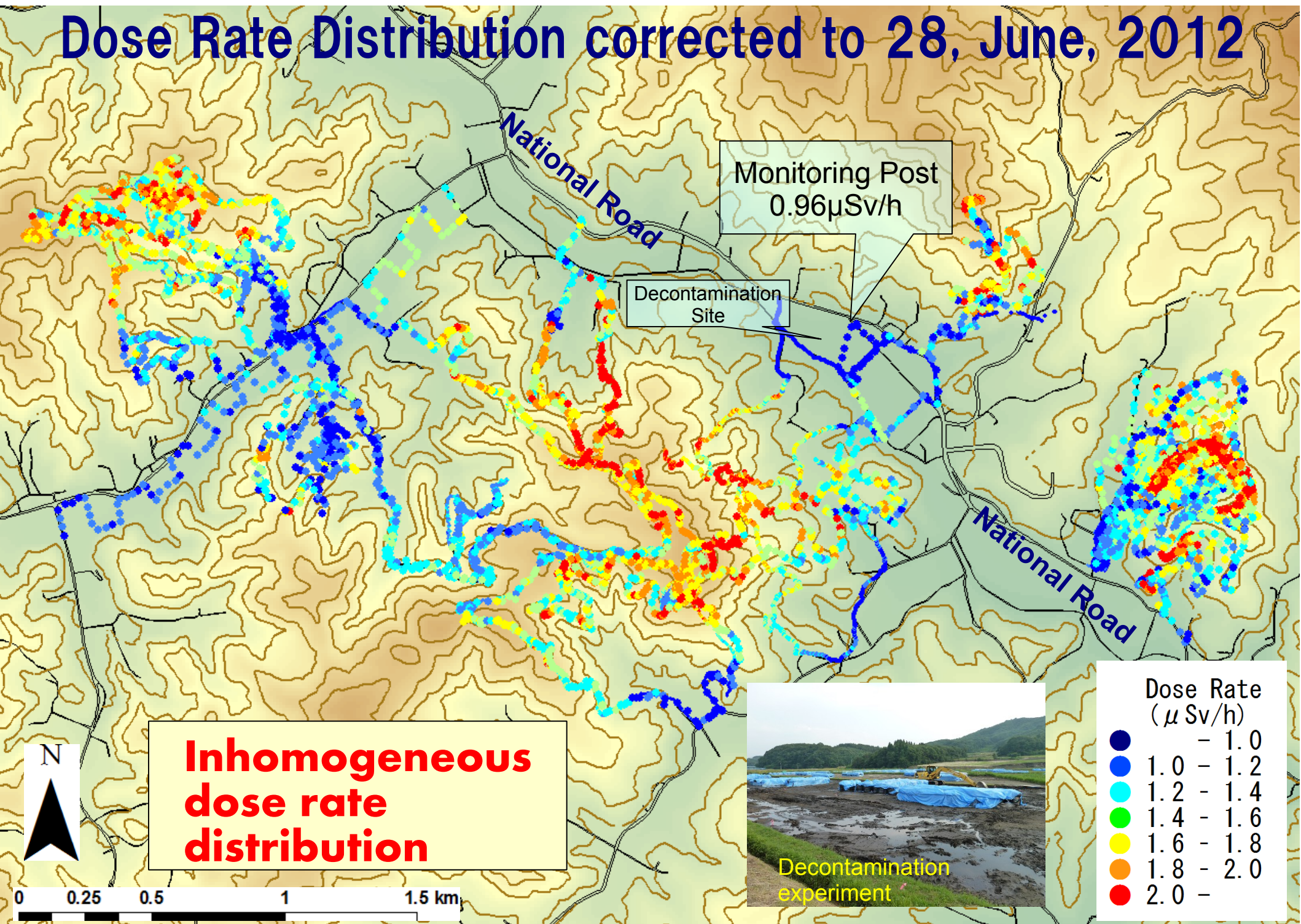
Life in mountain village depends on water and material cycles in SATOYAMA watershed

- Carry spectrometer in the rucksack
- Synchronized with GPS
- Waling along mountain slope

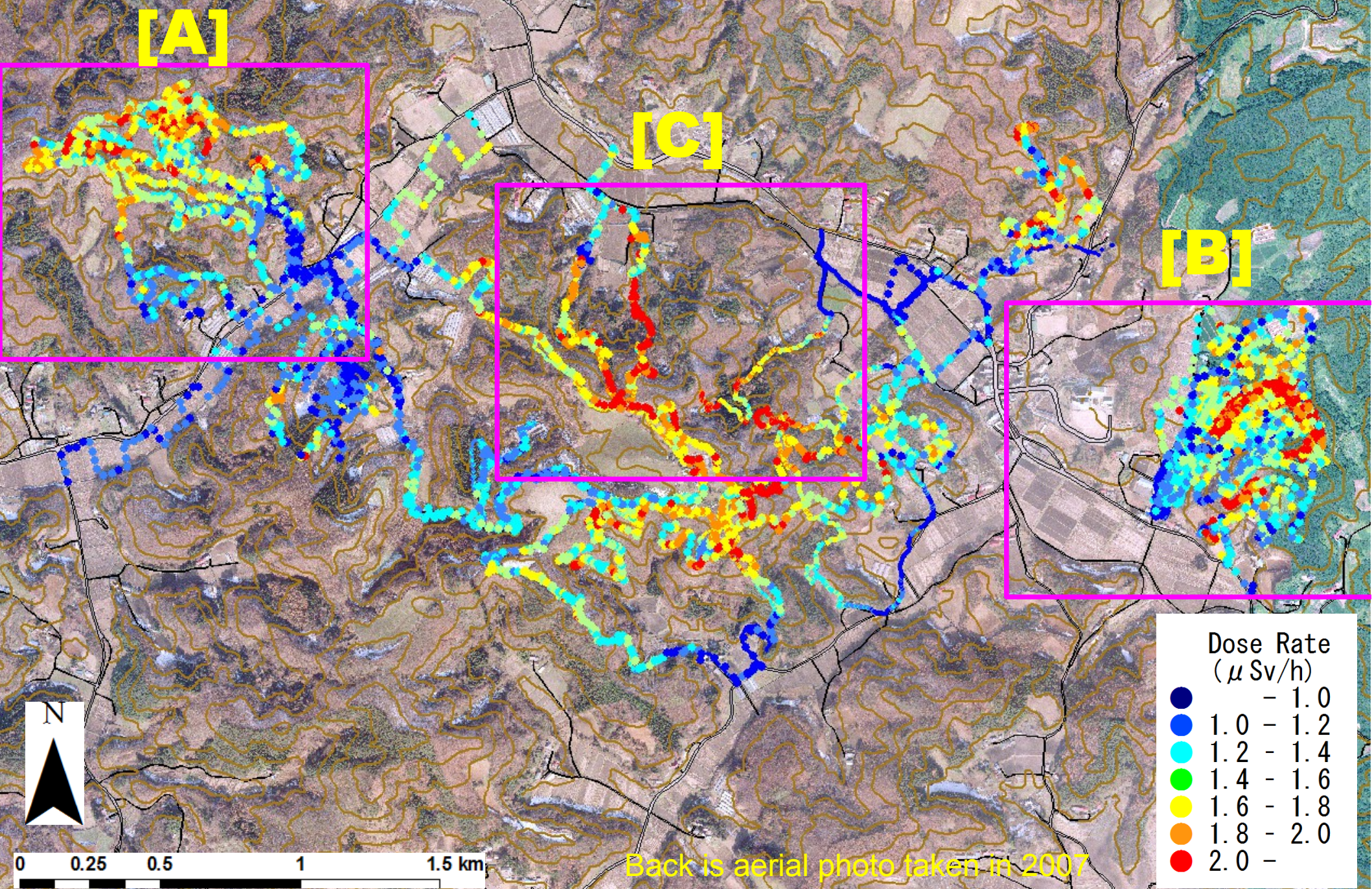


Central part of Yamakiya

# Dose Rate Distribution corrected to 28, June, 2012

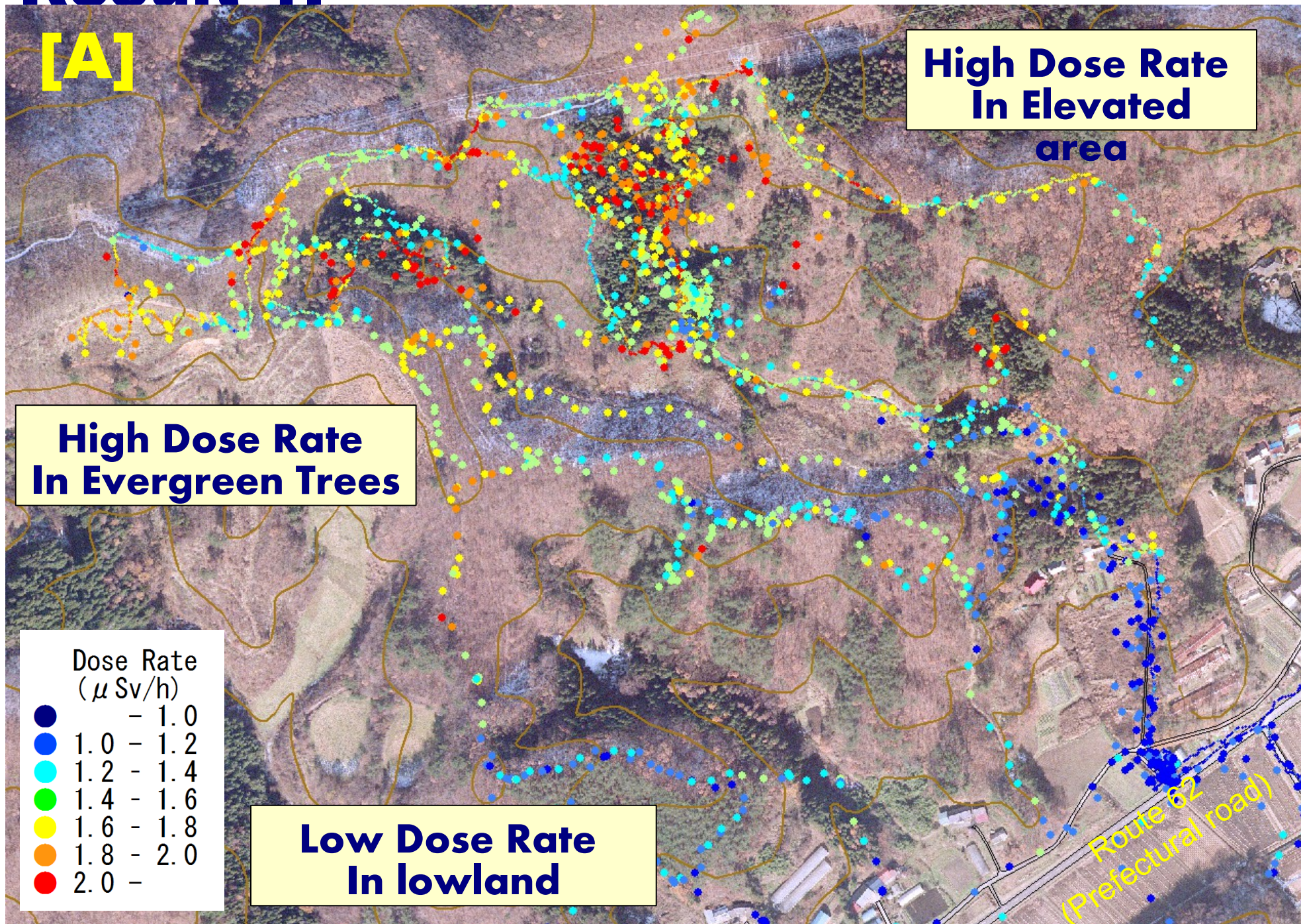


# Characteristics of dose rate distribution



# Result 1.

Base date: 28 June, 2012



# Result 2.

Base date: 28 June, 2012

[B]

**High Dose Rate  
In Upper Plateau**



Decontamination in SE-  
faced slope(Kobayashi  
Lab.)

**Low Dose Rate  
In Valley  
Bottom**

Dose Rate  
( $\mu$ Sv/h)

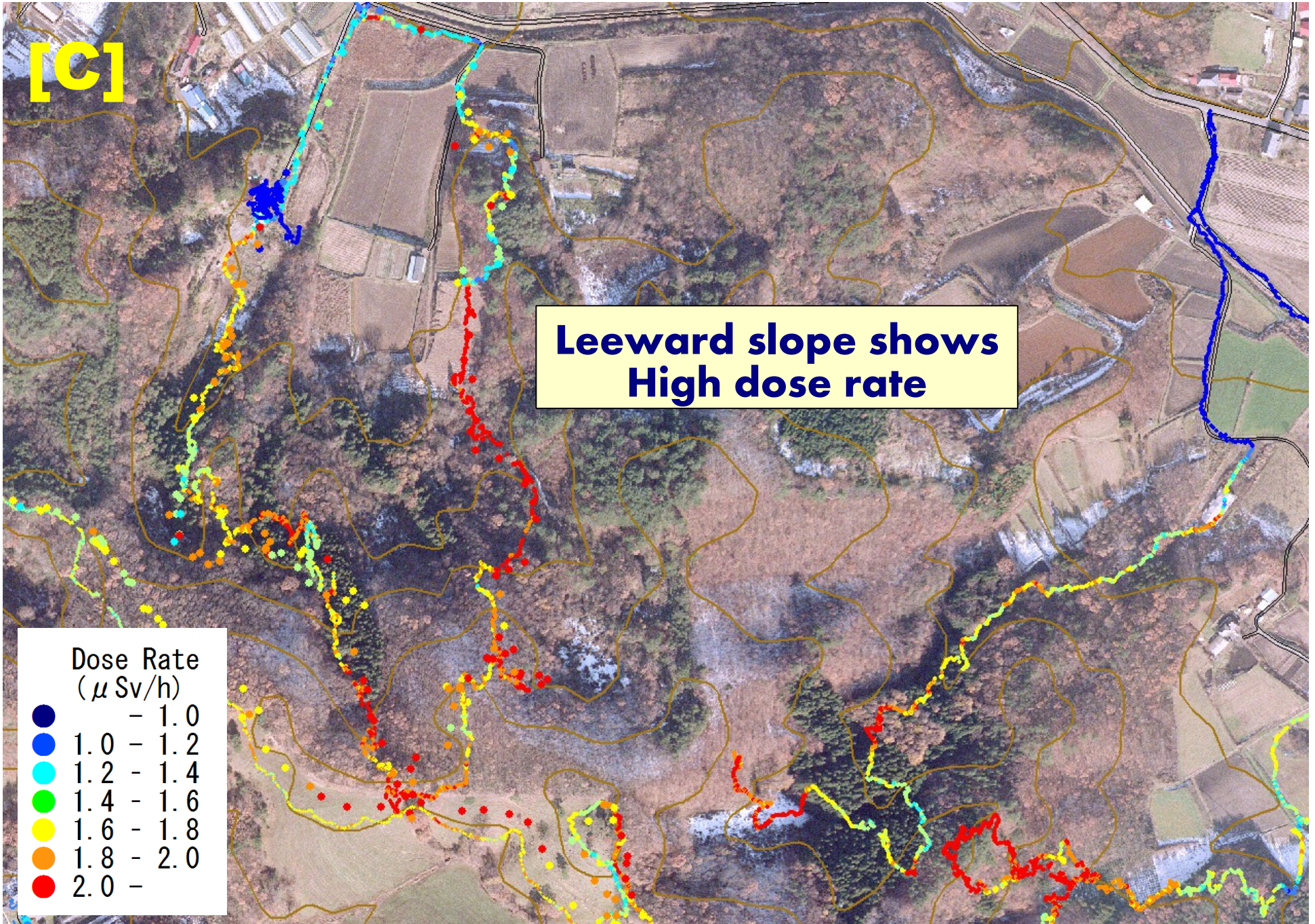


**High Dose Rate  
In SE-faced Slope**

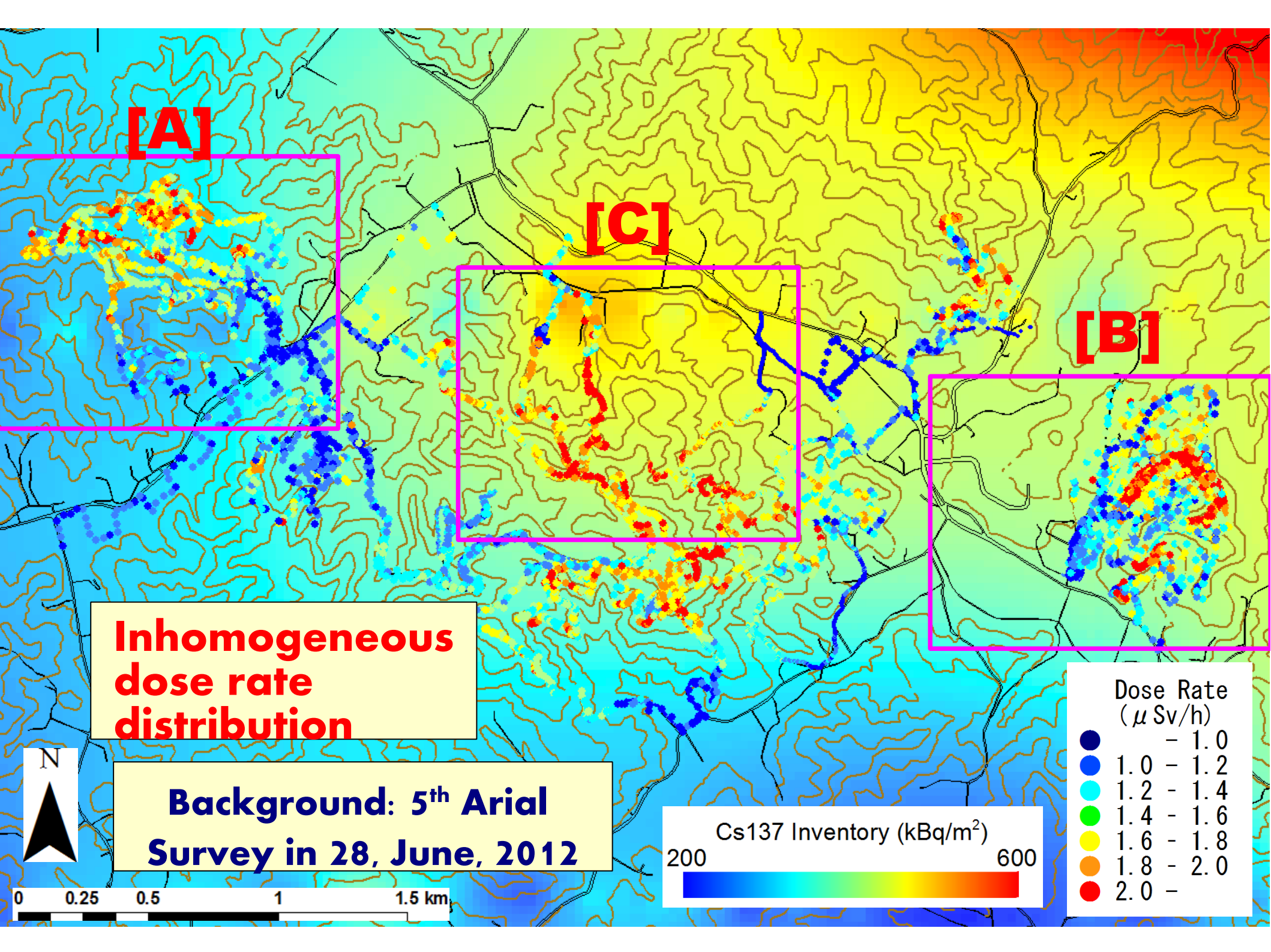


# Result 3.

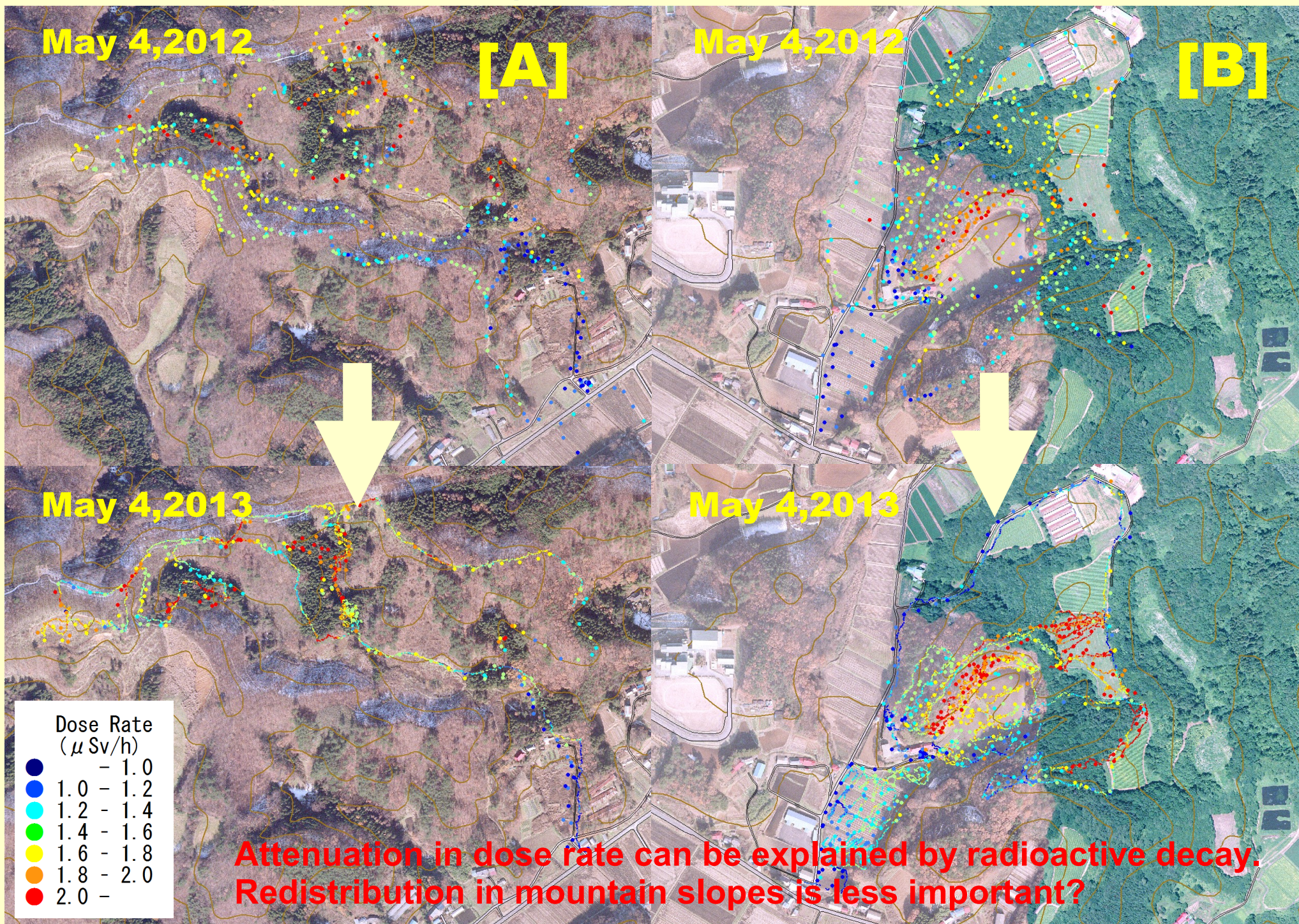
Base date: 28 June, 2012







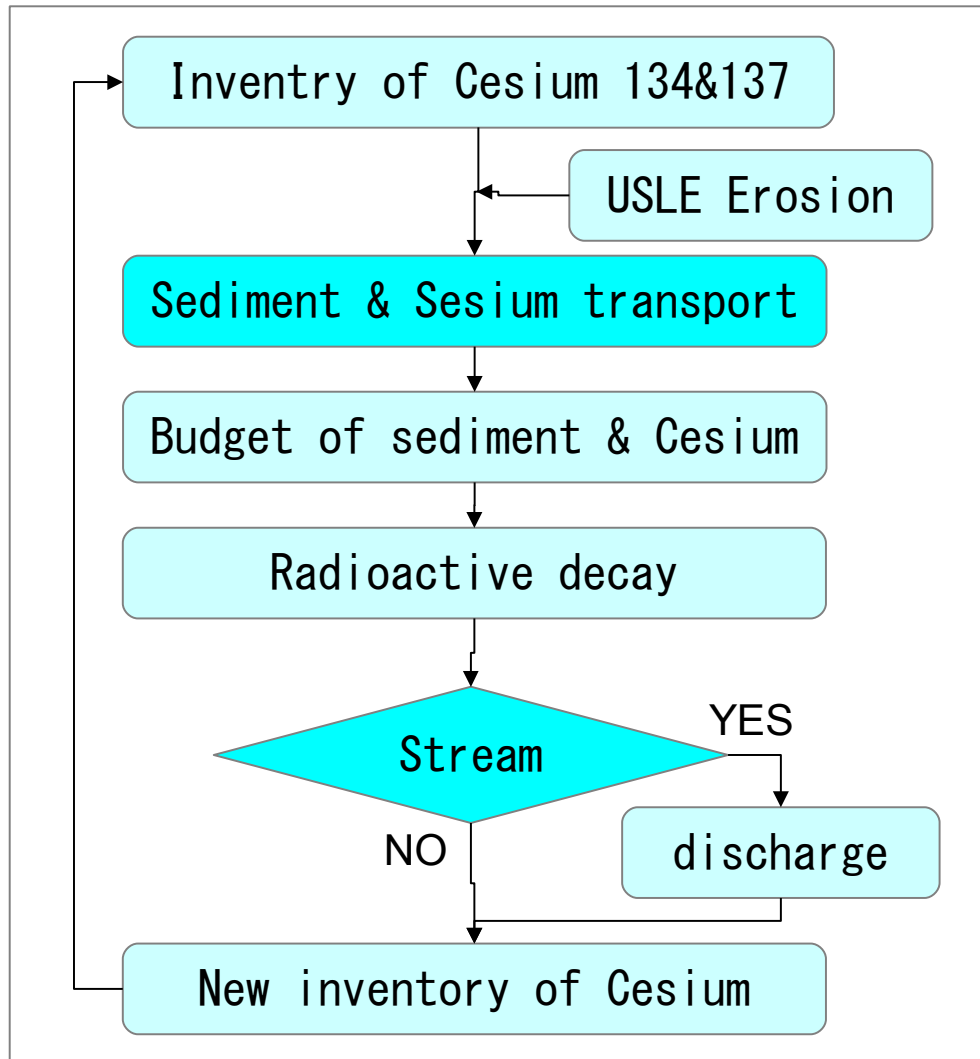
# Dose rate change between May 4<sup>th</sup>, 2012 and 2013 corrected to base date



# Trace Sediment and Cesium Downslope

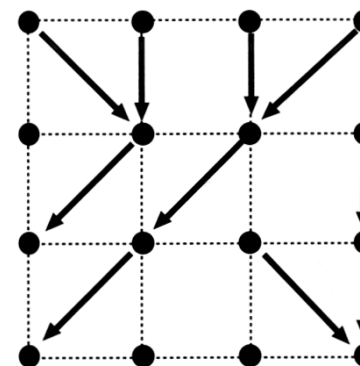
Trace sediment to downslope  
With radioactive cesium

30 years iteration



- USLE erosion rate (FMWSE)
- Flowed to downslope with Cesium
- At the stream (recognized by TPI), Cesium is flushed to down stream

Stream line

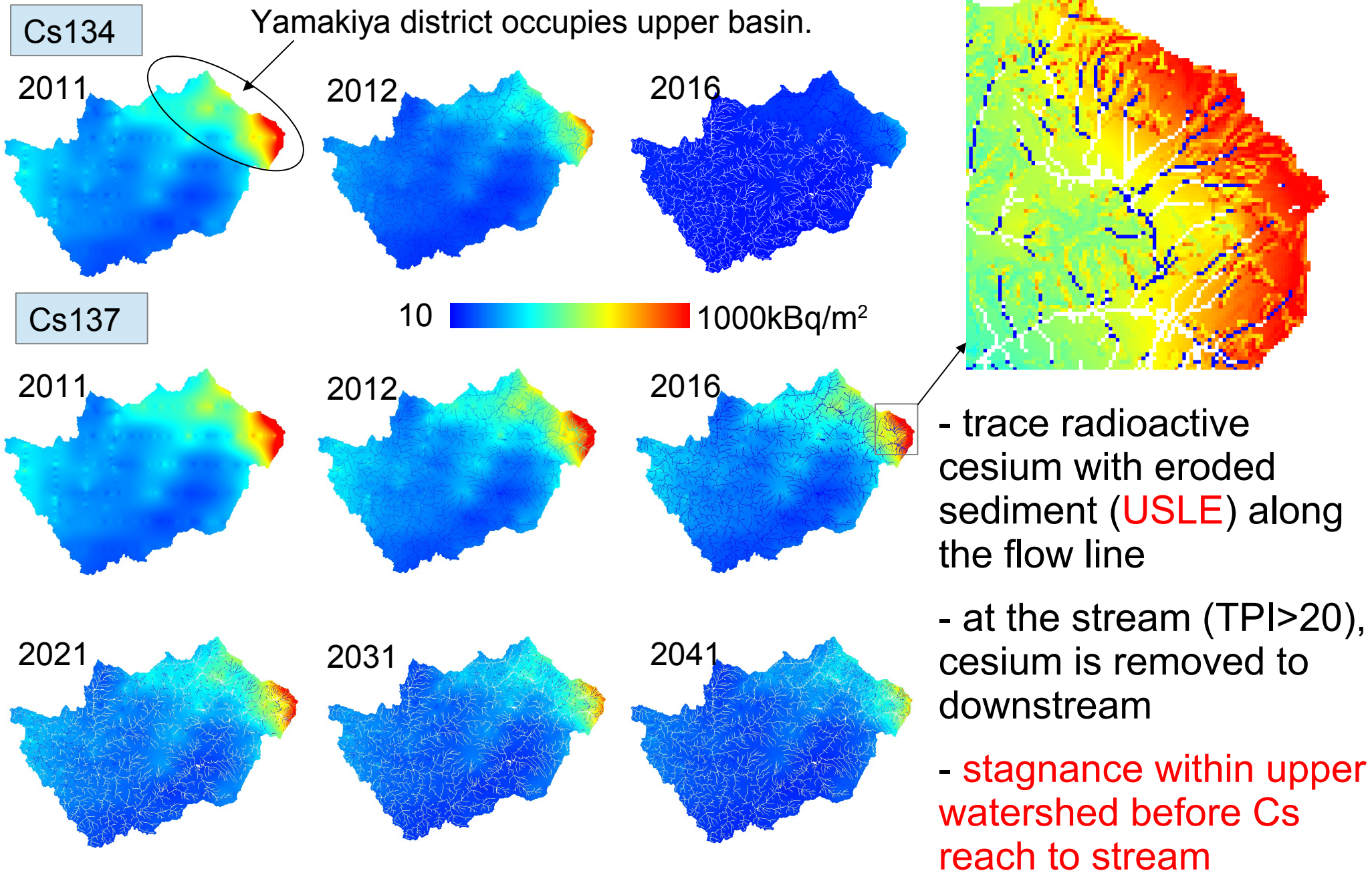


Topographic Index (TPI)

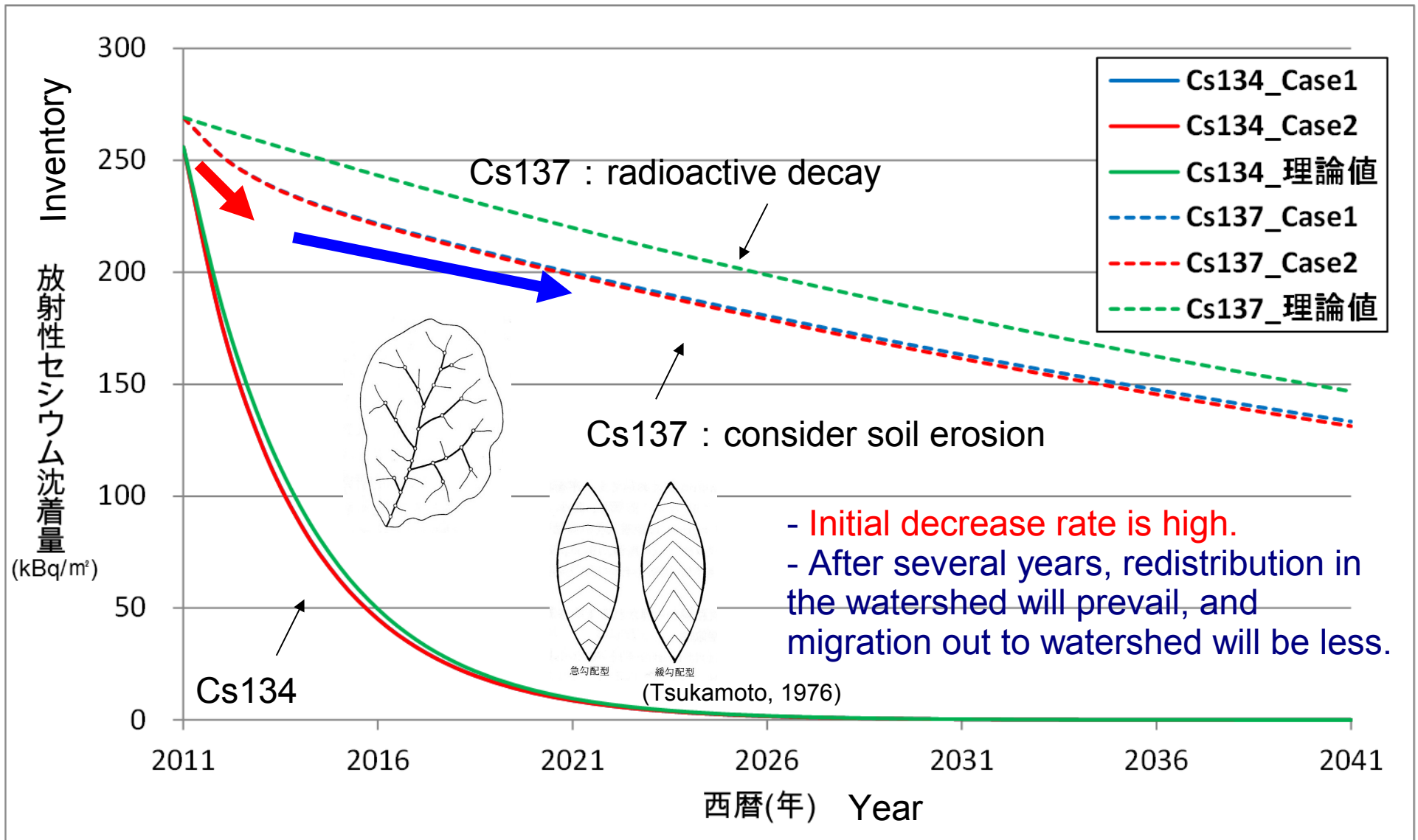


0 20

# Rough estimation on the changes in Cs134 & Cs137 Inventory in the Kuchibuto-gawa watershed



# Changes in average cesium inventory in Kuchibuto-gawa watershed



**Redistribution within the watersheds is major process in mountain area.**

# Long term battle to radioactive cesium has just started.

## Conclusions on dose rate distribution

- Dose rate distribution map in small and large scales are shown.
- Dose rate is high in high altitude and windward(N.P.P. side) slope.
- Initial fallout pattern affect the dose rate distribution.
- Vegetation(evergreen and deciduous) are important factor to estimate dose rate distribution.

## How we geographers act?

- Consider the regional characteristics.  
<Japan is densely populated land.>
- The scale closely related to mountain life is watershed scale. We have to consider the restration in SATOYAMA watershed scale.
- Take continuous action.

Cherry blossoms in Nagadoro, May 6<sup>th</sup>, 2013