



The status, research progress, and new application of soil inventory in Japanese agricultural land

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Researchers of our institute, as well as other soil scientists in Japan, have actively contributed to the activities of Asian soil science network over a period of many years. Recently, many of these activities are based on the East and Southeast Asia Federation of Soil Science and Society (ESAFS) and its soil information WG is a good example. Therefore, We hope that GSP Asian RSP builds close collaboration with these existing networks and contribute to the development of active partnership for sustainable management of soil resources in Asia.

History of National Soil Survey Programs in Japanese Agricultural Land (1885-1948)

Agro-geological Maps (1:100,000)



Max Fesca
(1845-1919)

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歴史的農業環境閲覧システム



History of National Soil Survey Programs in Japanese Agricultural Land (1953-1978)

- Soil Survey for Improving Fertilizer application (1953-1961)

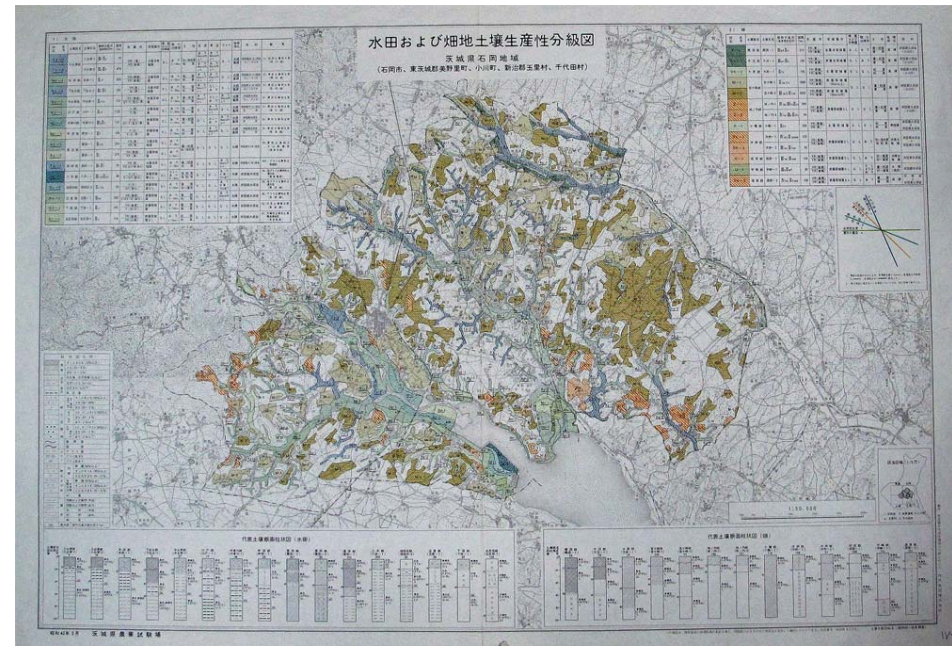
Mainly in paddy field, about 200,000 pedons were surveyed.

- Fundamental Soil Survey for Soil Fertility Conservation (1959-1978)

Mainly in upland field, the survey density was 500m.

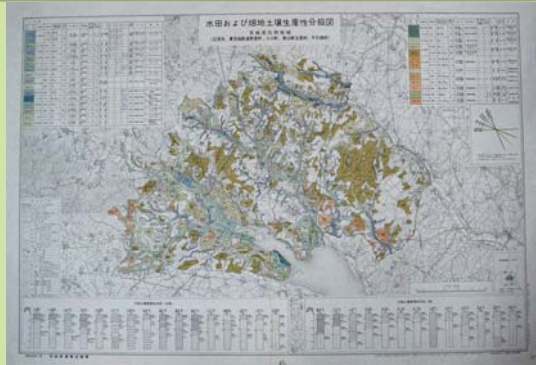


Summaries of Pedon dataset
(47 prefectures)



Cultivated soil maps (1:50,000)

Digitalized and updated cultivated soil maps (1: 50,000)



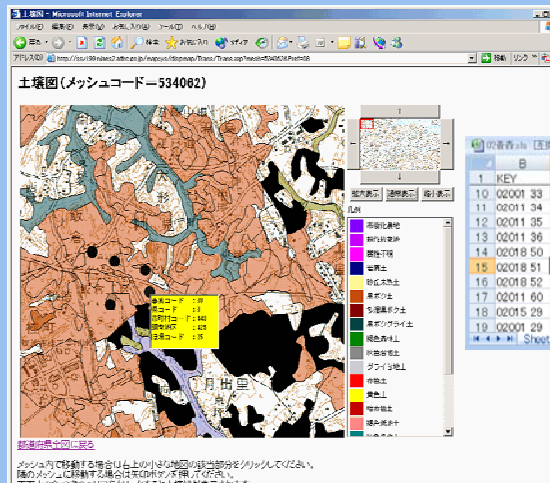
Cultivated soil maps (1:50,000)



Benchmarked soil dataset (about 20,000 sites)

- Soil Survey for Improving Fertilizer application
- Fundamental Soil Survey for Soil Fertility Conservation

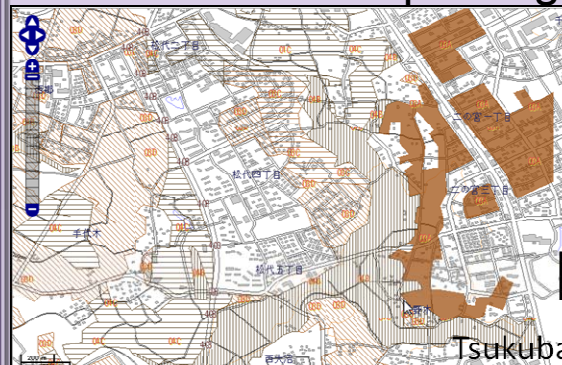
Digitalized soil inventory



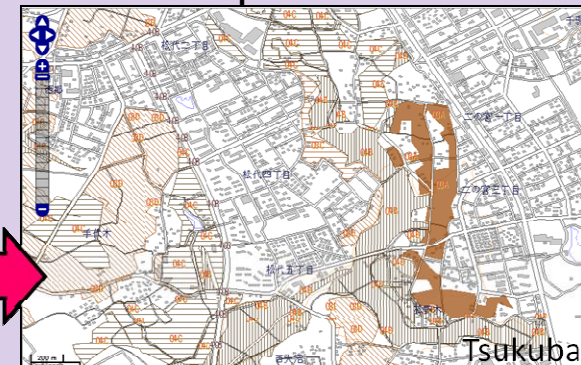
Digital soil map

Benchmarked soil pedon database

Updating soil-land map



1992 version



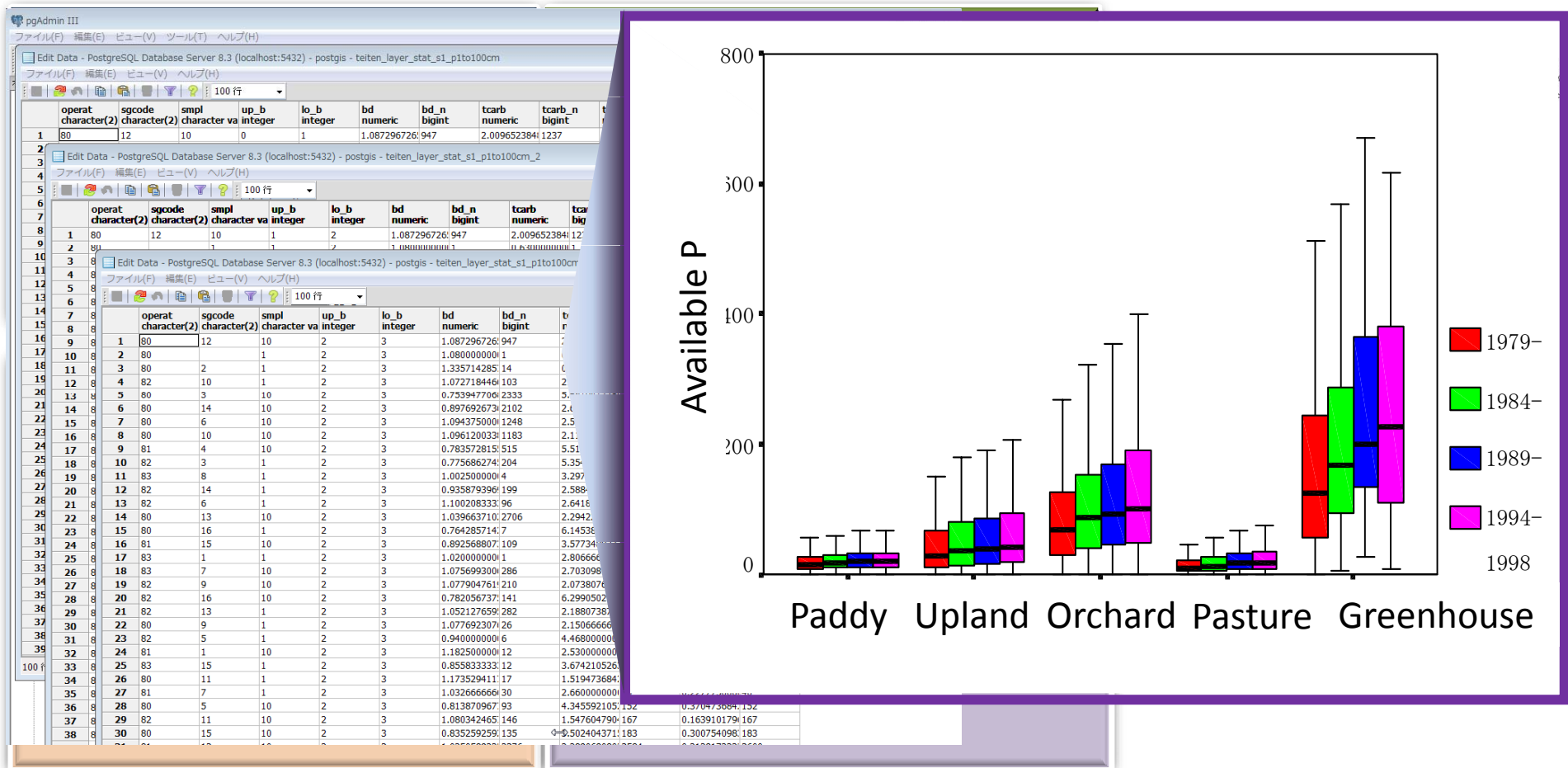
2001 version

Urban sprawl impacts on fertile soils

History of National Soil Survey Programs in Japanese Agricultural Land (1979-1999)

Basic Soil - Environment Monitoring

About 20,000 monitoring sites.
5-year-interval (Since 1979)



History of National Soil Survey Programs in Japanese Agricultural Land (1999-)

1) Soil survey program for monitoring soil function (1999 -)

Downsizing of the Basic soil-environment monitoring
(Monitoring sites were decreased from 20,000 to 5,000)

2) A national soil survey program for monitoring soil carbon content and soil management in Japan (2008 -)

In order to monitor variations in soil carbon content of arable lands and effects of agricultural management practices (3,500 monitoring sites)

-
- Developing the Comprehensive soil classification system of Japan (seamless between cultivated and forest area)**
 - Upgrading a seamless digital soil map at scale 1: 250,000 using the Comprehensive soil classification system (also WRB 2006 will be used).**

Contents

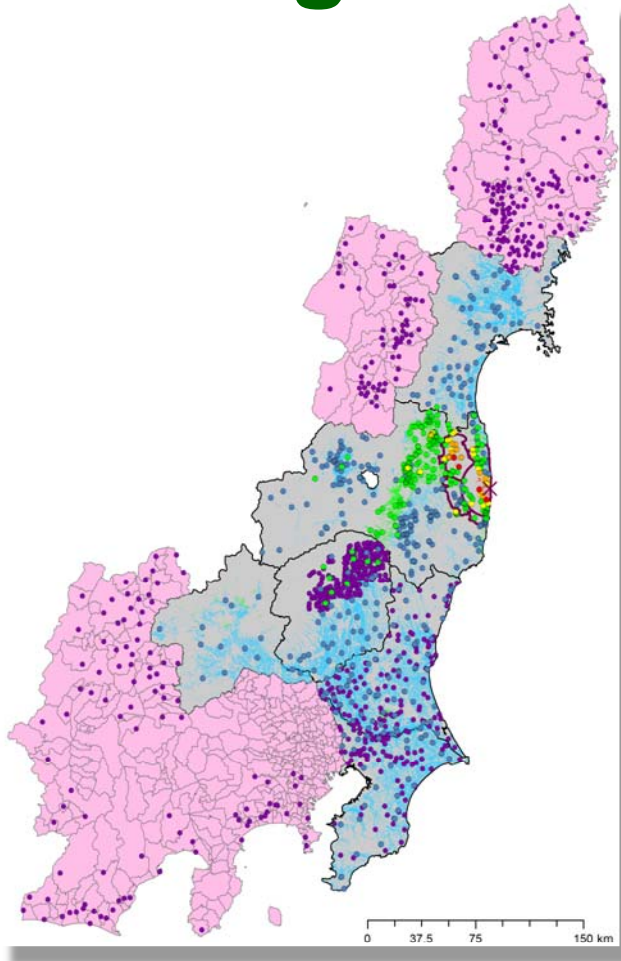
-  **History of national soil survey program and status of soil inventories**
-  **Application of soil inventory 1**
- Agro-environmental indicators -
-  **Application of soil inventory 2**
- Status of utilization and demands of soil information in Japan -

Cultivated soil area in Japan

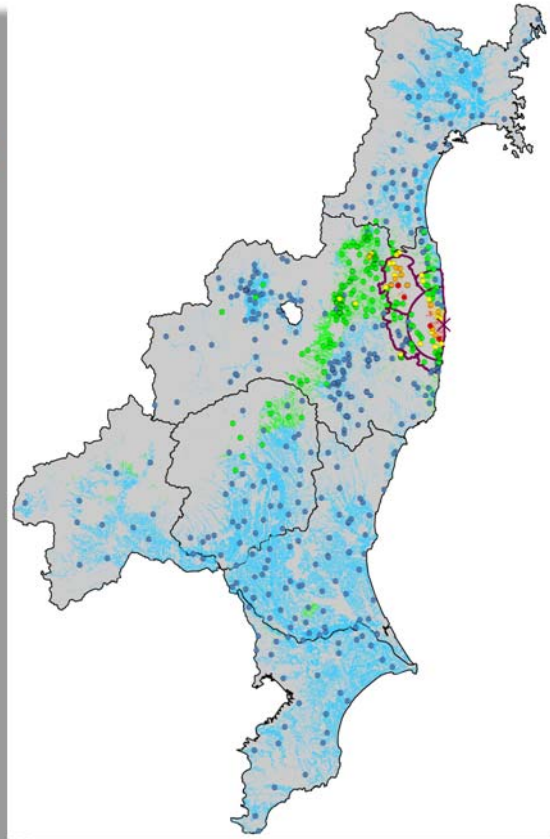
Soil Group	No. of Soil Series Group	Soil Group (WRB)	Area (x1000 ha)		
			1973	1992	2001
Gray Lowland soils	9	Fluvisols, Gley soils	1275	1157	1072
Gley soils	7	Fluvisols	1027	908	848
Andosols	5	Andosols	1007	944	879
Brown Forest soils	3	Cambisols	483	426	362
Wet Andosols	5	Gleyic Andosols	384	419	397
Other soils	31		1498	1347	1231
Total			5675	5202	4790

Application of soil inventory in Japanese agricultural land 1

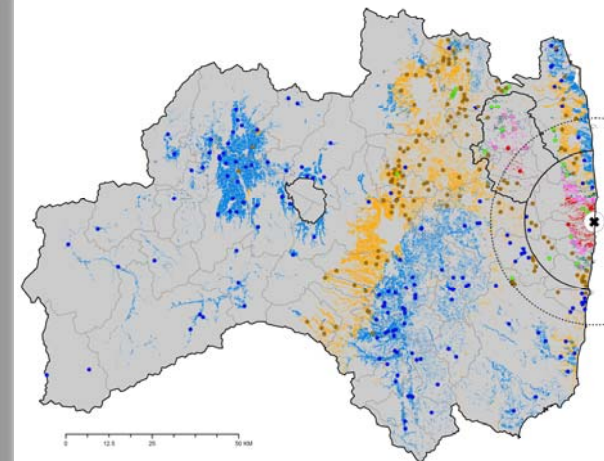
Agro-environmental indicators



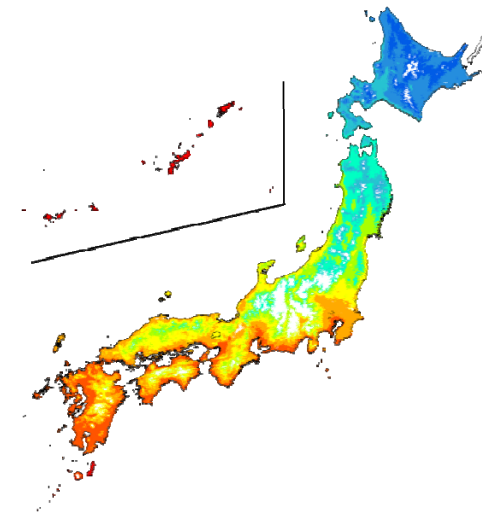
**Radioactive Cs
Concentration map
(Mar. 2012)**



**Radioactive Cs
Concentration map
(Dec. 2011)**



**Radioactive Cs
Concentration map
(Aug. 2011)**



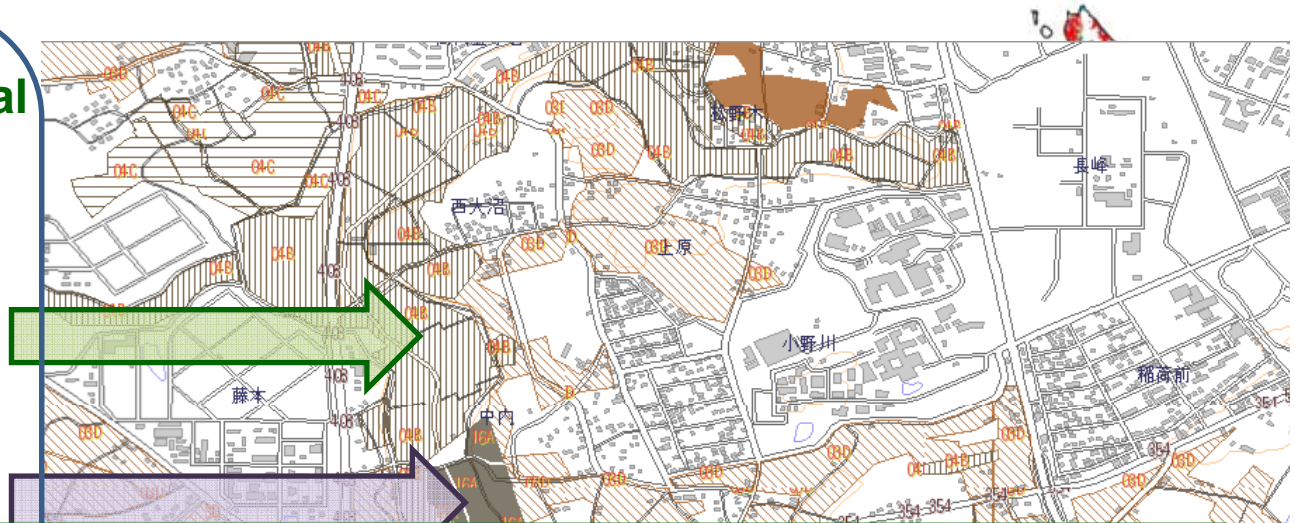
**Soil Temperature
Map**

Expanding the survey area

Categorical method

“Basic Soil-Environmental Monitoring Project” data

Soil carbon content (g/kg)
Bulk density

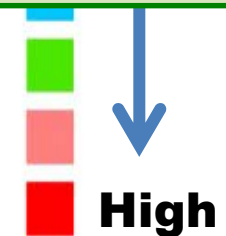


Categorical method has an environmental bias.

(SSG_LU categories) in each 1cm layer.

240 SSG_LU categories

60 SSG and 4 land use (paddy, upland, orchard, grassland)

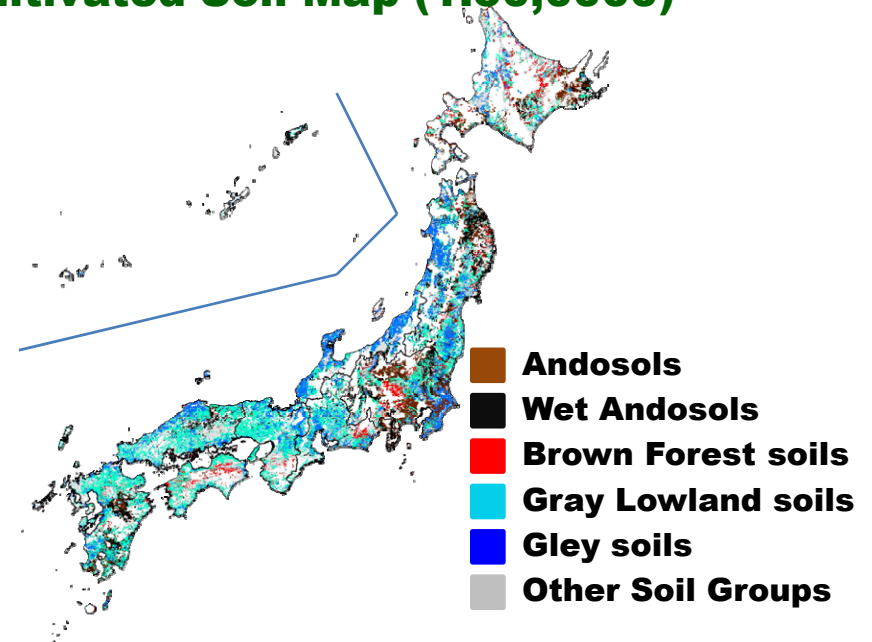


Basic Soil - Environment Monitoring

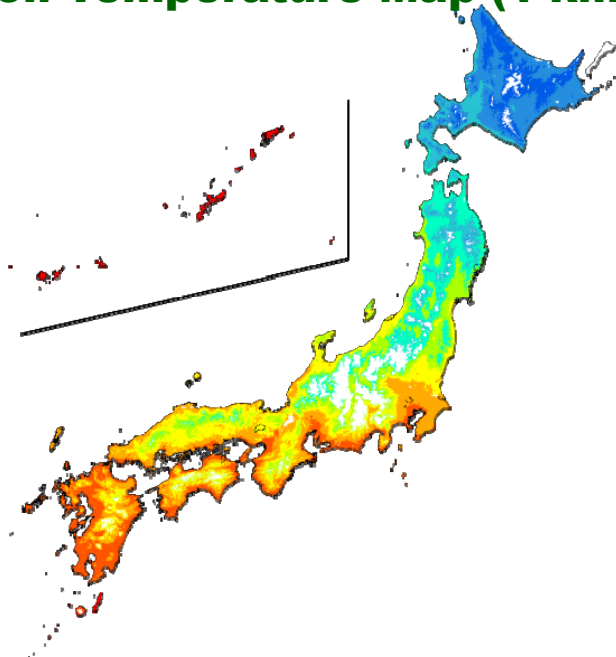
About 20,000 monitoring sites.
5-year-interval (Since 1979)

Site information	Soil profile description
<ul style="list-style-type: none">· Site· Latitude Longitude· Soil type· Sampling dateothers	<ul style="list-style-type: none">· Depth of horizons· Color· Structureothers
Activity data	Soil properties
<ul style="list-style-type: none">· Soil treatment· Fertilizer application· Crop rotation· Irrigation/Drainageothers	pH, EC, Soil texture, C and N content, Bulk density, available P, CEC, Ex-cations, pF, Solid-liquid-gaseous phase, Hydraulic conductivity, others

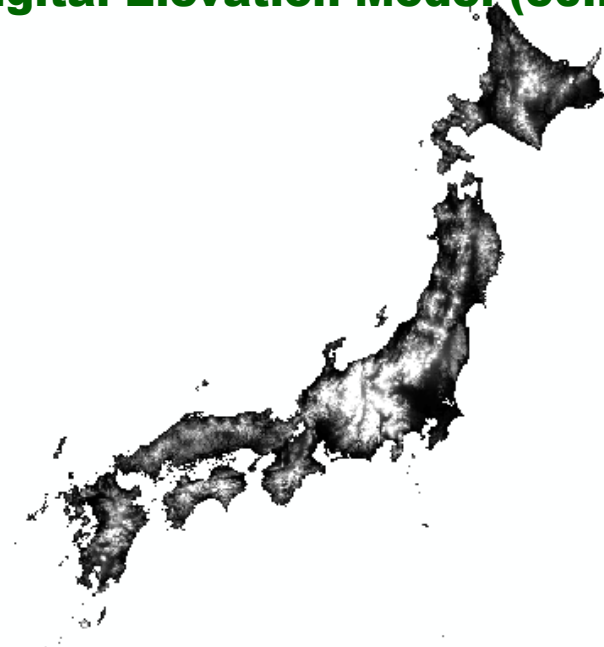
Cultivated Soil Map (1:50,000)



Soil Temperature Map (1 km)



Digital Elevation Model (50m)



Environmental bias (Soil temperature)

Residuals (tC/ha)

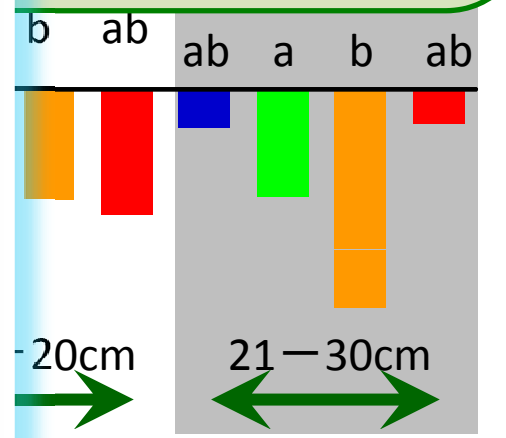
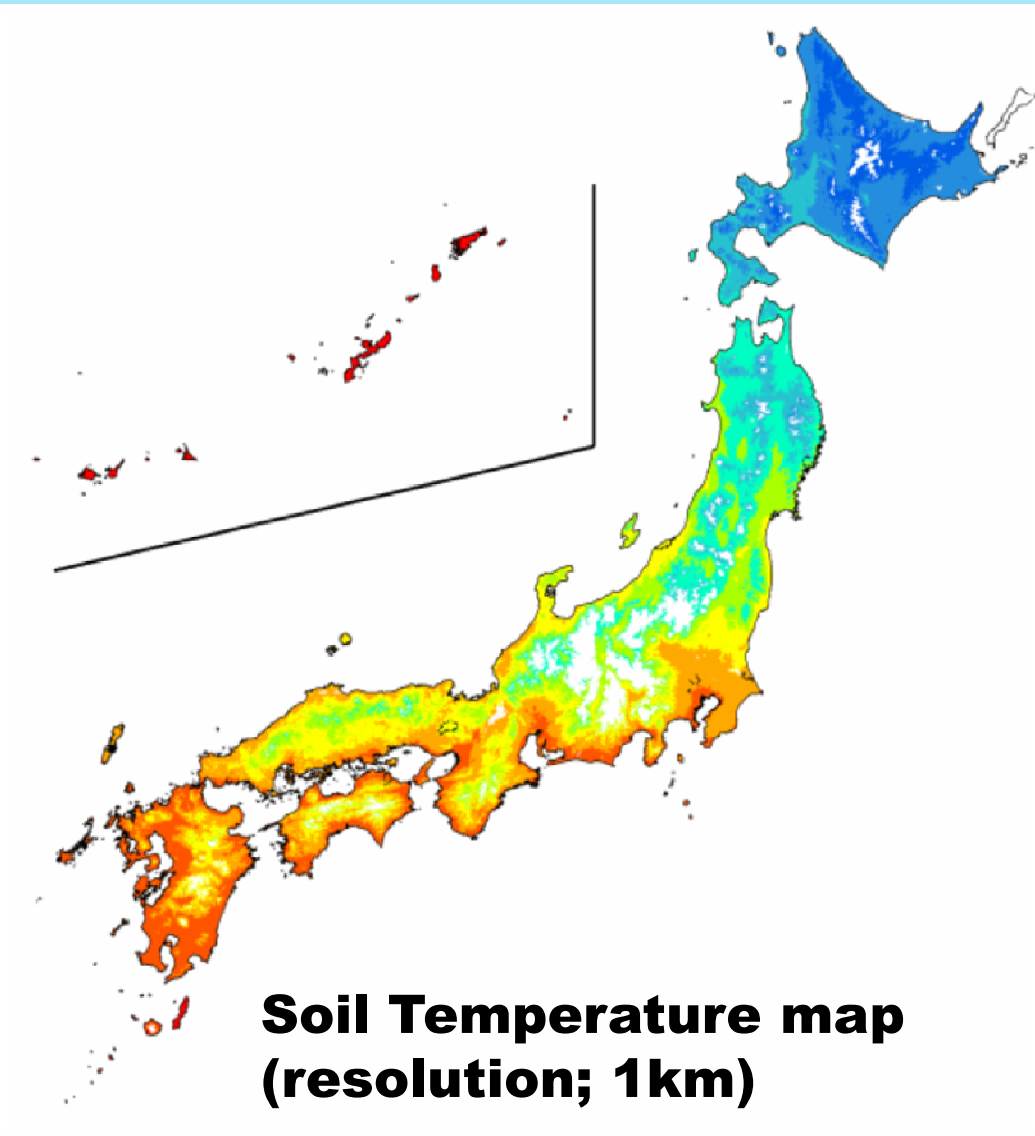
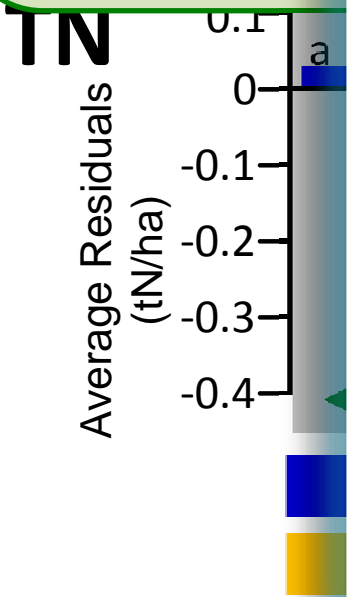
= Measured values – Categorical values

* Residuals (tC/ha) > 0; Underestimation

* Residuals (tC/ha) < 0; Overestimation

Both
Cool
Warm

Estimated
Estimated



(more than 22 °C)

Environmental bias (Sloping Upland SCS – Landform)



- Convex
- Plane
- Concave

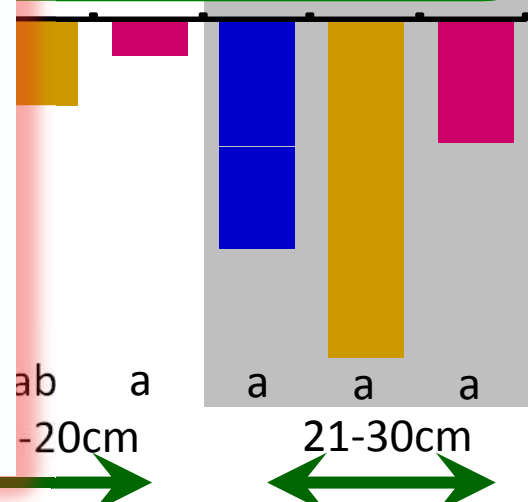
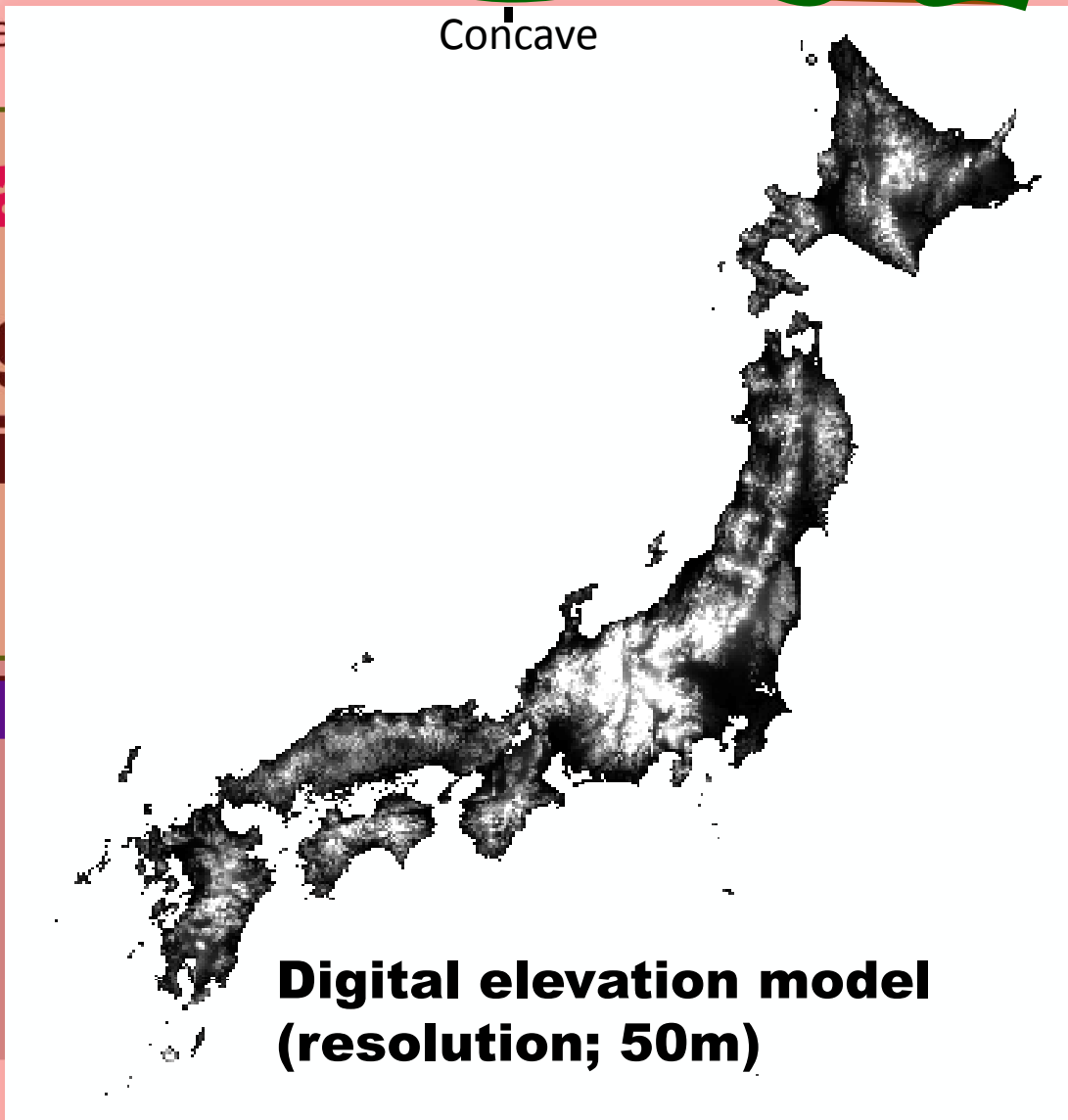
Gentle Slope
3 - 8 degree

Upland
Categories
SCS

estimates

Average Residuals
(tC/ha)

0
-5
-10



Hybrid-kriging method

$$\text{Residuals} = \text{Measured data} - \text{Predicted data} \quad \text{Eq.1}$$

(Point data) (SCS or TN Point data) (Map data)

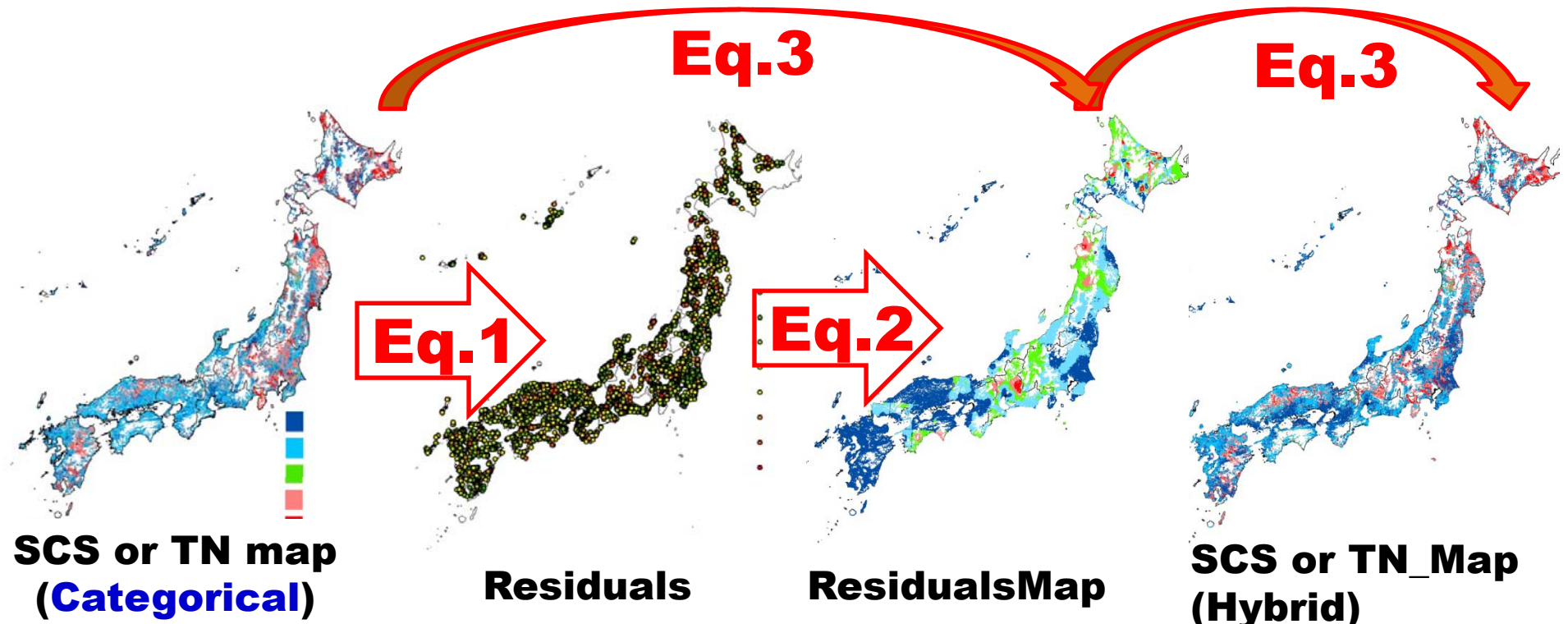
Predicted data was provided by **Categorical Method**

$$\text{ResidualsMap} = \text{Ordinary kriging (Residuals)} \quad \text{Eq.2}$$

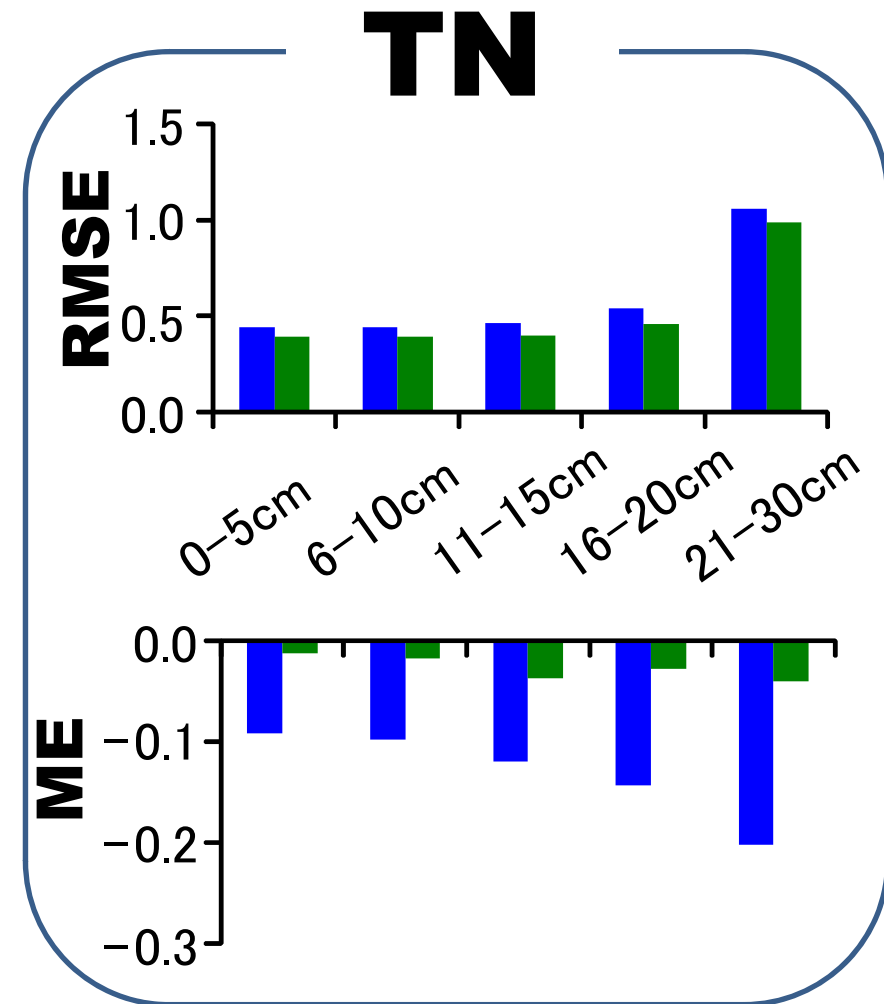
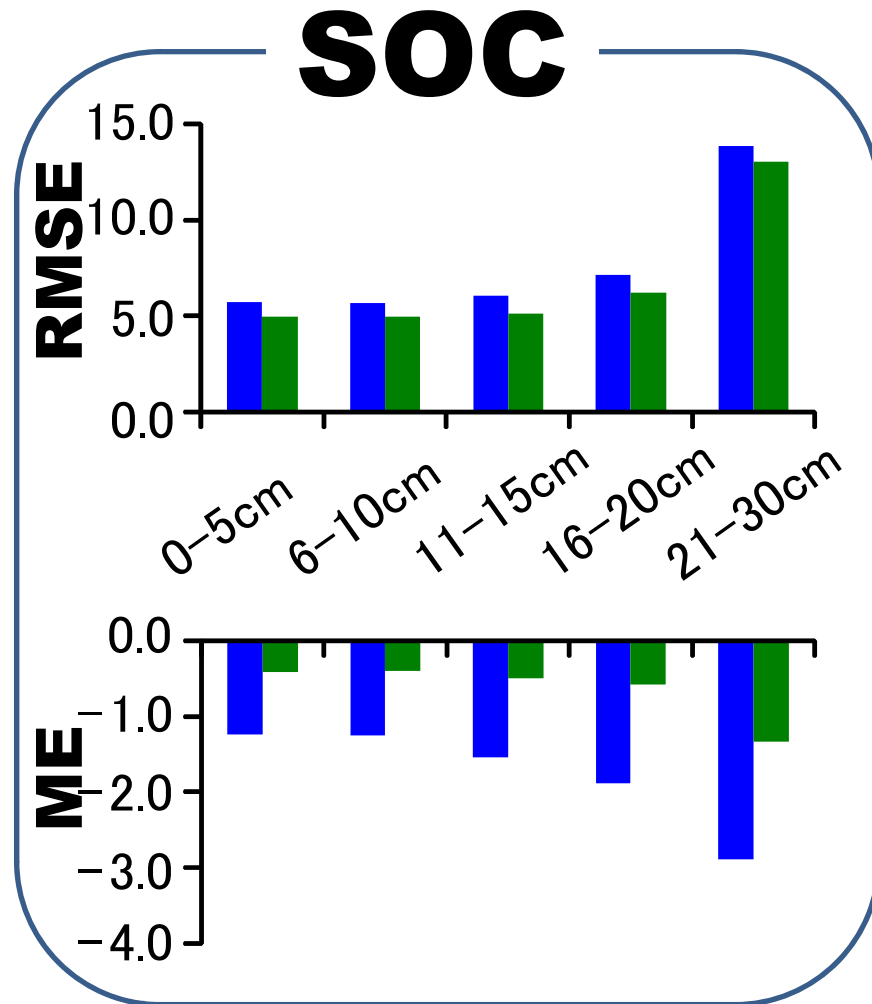
(Map data) (Point data)

$$\text{SCS or TN_Map} = \text{Predicted data} + \text{ResidualsMap} \quad \text{Eq.3}$$

(Map data) (Categorical) (Eq. 2; Map data)



Comparison accuracy between **Categorical method** and **Hybrid kriging method**.



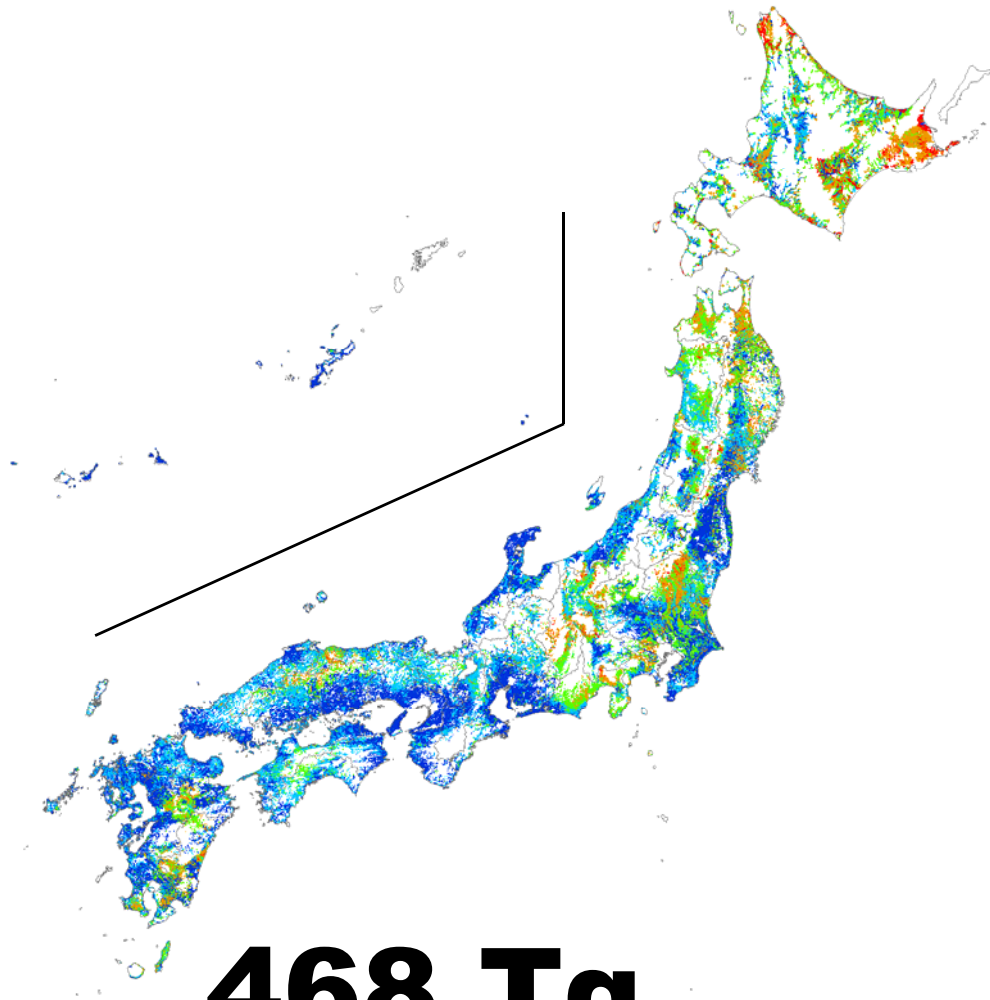
■ **Categorical**

■ **Hybrid-kriging**

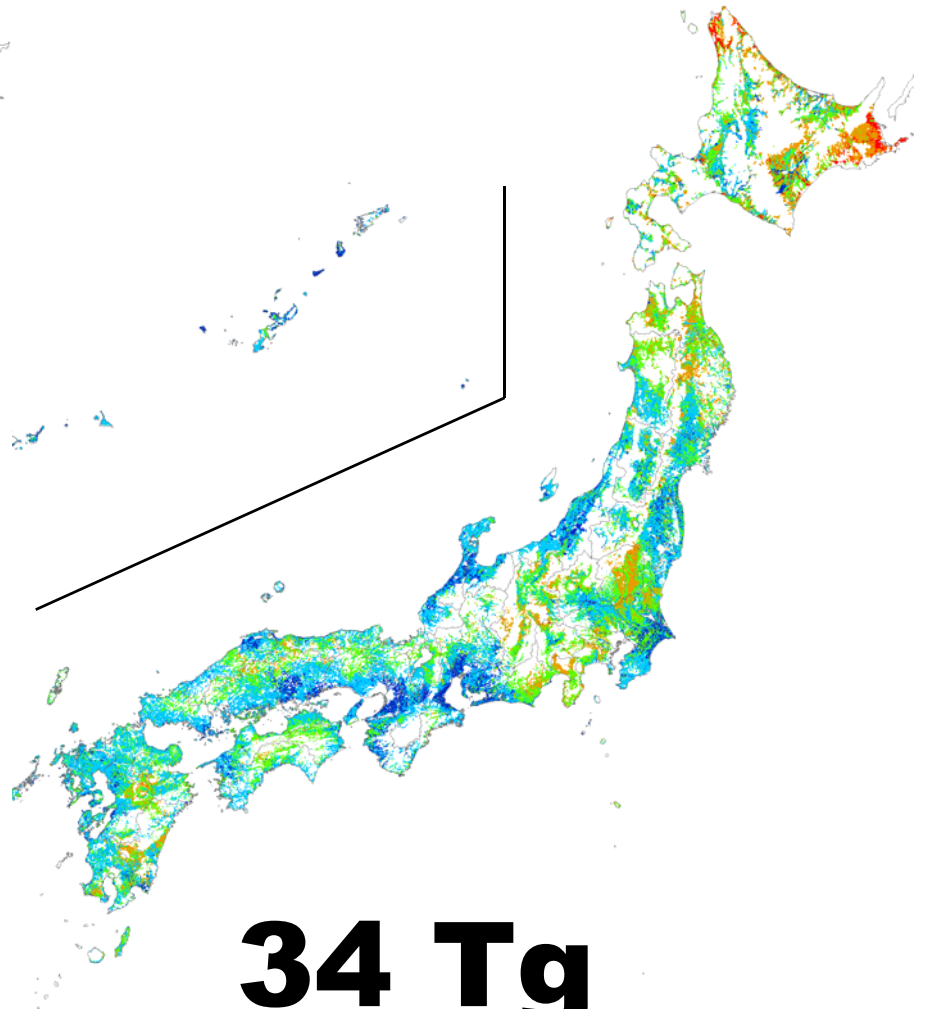
RMSE; Root mean square error, $\text{SQRT}\{1/N * \Sigma(\text{mean error})^2\}$

ME; Mean error, $1/N * \Sigma(\text{Measured values} - \text{estimated values})$

SCS and TN Map (1989-1993)

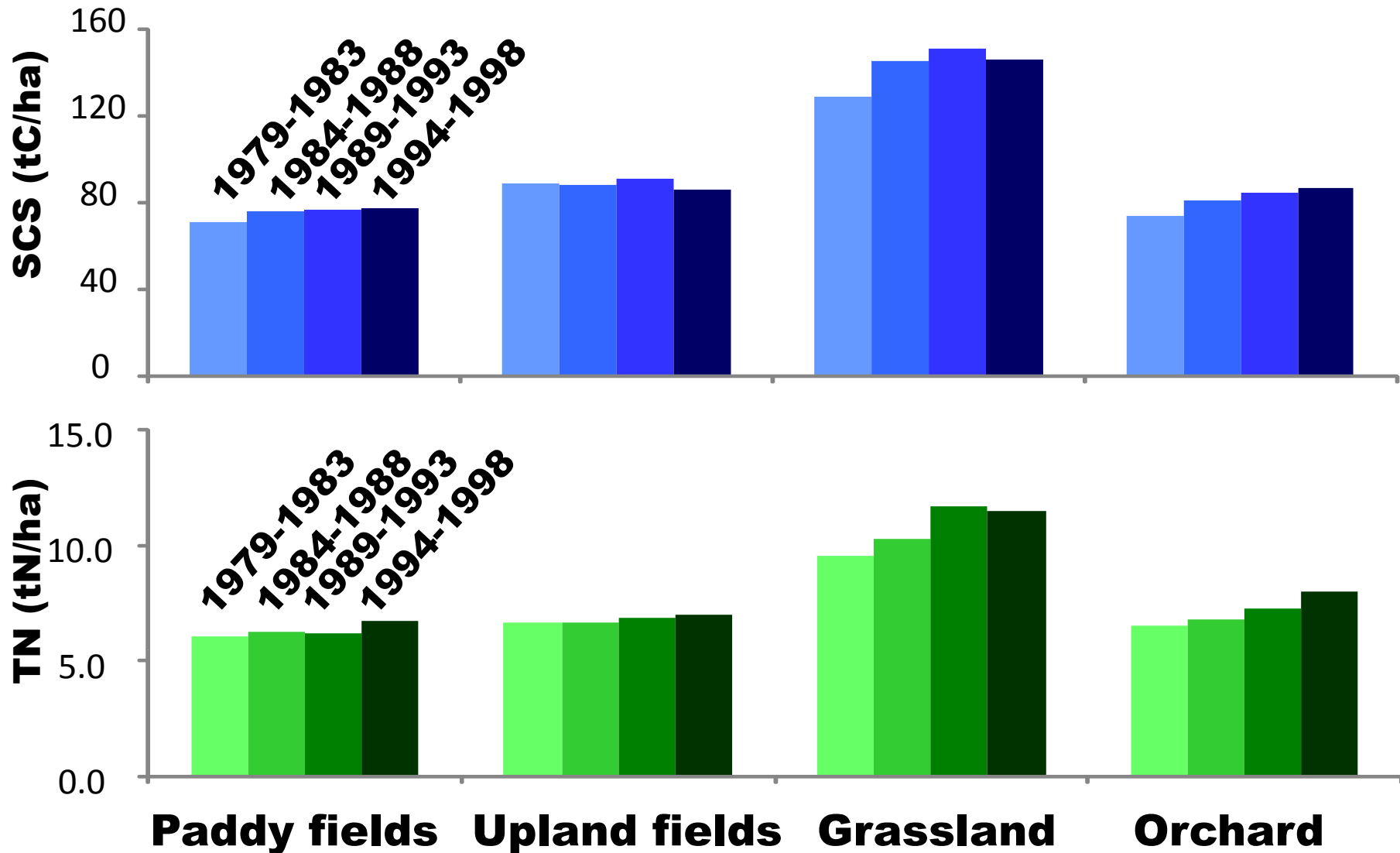


468 Tg
SCS map



34 Tg
TN map

Temporal variation of SCS (tC/ha) and TN (tN/ha) in each land use type



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Application of soil inventory in Japan 2

Soil Information WEB Viewer

http://agrimesh.dc.affrc.go.jp/soil_db/

Soil classification

Soil map viewer

Soil surface DB

Soil profile DB
(7,115 pedons)

Soil temperature
map (1km) viewer

Archive on the
historical soil map

岩屑土
山地、丘陵地の斜面に分布する土壌で、土層は浅く、表層下30cm以内から礫層や岩盤があらわれる

砂丘未熟土
主として砂丘地、および旧海岸線沿いの砂堆、砂州、ならびに砂嘴などの高地ないし微高地に分布する砂質

黒ボク土
黒ボク土は、主として火山灰を母材とし、良好な排水条件下にある母材の風化平原で有機物が集積したことに由来し、表層を土壌である。
黒ボク土は、主として火山灰を母材とし、良好な排水条件下にある母材の風化平原で有機物が集積したことに由来し、表層を土壌である。

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土壌情報閲覧システム

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土壌断面データベース閲覧 > 茨城

表示するデータベース:
基礎 水田

Base Layer
* 基礎地図情報25000

Overlays
 岩屑土
 砂丘未熟土
 黒ボク土
 多量黒ボク土
 黒ボククワイ土
 褐色森林土
 灰色台地土
 クワイ台地土
 赤色土
 黄赤土
 暗赤土
 褐色低地土
 灰色低地土
 クワイ土
 黒土
 黄土

水田土壌断面

ID	土地利用	土壌統名	土壌統群名	土壌群名	地質	母材	地形
8016	水田	大田和	表層腐植質多量黒ボク土	多量黒ボク土	河成沖積土	非固結火成岩(火山灰)水積(河成堆積)	台地間谷津入口平地

PDF PDF

閉じる

50cm

100cm

150cm

ツルコケモミズクヌマヤスグ

スワヤスグ

ハンノキヨシ

(クリックして拡大)
泥炭土
北海道 美幌市開成町

(クリックして拡大)
厚層多腐植質黒ボク土(O3A)

(クリックして拡大)
死灰土が広く分布する網走湿原

(クリックして拡大)
ハンノキ

有腐植質層の厚さ
50cm以上
有腐植質10%以上
10%未満
厚層多腐植質黒ボク土(O3A)

有腐植質層の厚さ
50cm以上
有腐植質10%以上
10%未満
厚層多腐植質黒ボク土(O3B)

有腐植質層の厚さ
50cm以下
有腐植質10%以上
10%未満
表層多腐植質黒ボク土(O3C)

有腐植質層の厚さ
50cm以下
有腐植質10%未満
表層多腐植質黒ボク土(O3D)

有腐植質層の厚さ
50cm以下
有腐植質5%未満
淡色黒ボク土(O3E)

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土壌情報閲覧システム - Windows Internet Explorer

http://agrimesh.dc.affrc.go.jp/soil_db/figure/figure_map.phtml?def_code=14&map_lat=35.342226&map_lon=139.27956

土壌情報閲覧システム - Windows Internet Explorer

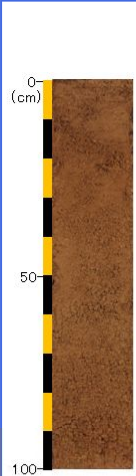
http://agrimesh.dc.affrc.go.jp/soil_db/explain_03E.phtml

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Home 使い方 土壌分類解説 土壌図閲覧 土壌温度区分図 土壌断面データベース閲覧 大日本帝国土性図 リンク集

土壌分類解説 > S3.黒ボク土

淡色黒ボク土(03E) Soil series groups (code)



有機物含量は5%以内で淡色黒ボク土である。火山灰台地および火山山麓などの地下水位の低い地帯に分布する。

①リン酸の固定力が強く、リン酸に乏しい(最近の傾向は土壌診断などを参照)。
②養分を保持できる容量は高いが、その保持力は弱く、過剰な施肥により酸性化しやすい。
③底比重は0.5-0.8と軽し、よな土壌のため風食・水食を受けやすい。
④保水力がやや小さく、乾燥のおそれがある。

Explanation of soil series groups

その他の淡色黒ボク土では、
①リン酸の固定力が強く、リン酸に乏しい(最近の傾向は土壌診断などを参照)。
②養分を保持できる容量は高いが、その保持力は弱く、過剰な施肥により酸性化しやすい。
③底比重は0.5-0.8と軽し、よな土壌のため風食・水食を受けやすい。
④保水力がやや小さく、乾燥のおそれがある。

Soil surface DB 作土層の理化学性の平均値

1979-1983, 1984-1988, 1989-1993, 1994-1998, 1999-2003

「サイトボタン」

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ページが表示されました

Base Layer
● 基礎地図情報25000

緯度 35.842226
経度 139.279560

Firefoxはテキストボックスを右クリックしてから選択して下さい

緯度経度指定表示
クリア
凡例を表示
切替土壌温度区分図
印刷

土壌図・年
1992年
2001年

大手町丁から検索

あまが丘平野
あまが丘

100%

分析値一覧(第1層) O3A 厚層多量積層黒ボク土 土壌理化学性調査 第1期目:1979-1983年

土壌利用	項目	01 厚層土		02 5層土		03 0層土		04 0層土		05 表層土		06 表層土		07 表層土		08 表層土		09 表層土	
		(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
高層	平均値	119	111	0.76	0.84	38.2	33.0	71.2	43.3	33.9	8.8								
	中央値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	標準偏差	42	48	0.01	0.01	1.9	1.3	1.6											
	範囲	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
中層	平均値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	中央値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	標準偏差	42	48	0.01	0.01	1.9	1.3	1.6											
	範囲	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
表層	平均値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	中央値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	標準偏差	42	48	0.01	0.01	1.9	1.3	1.6											
	範囲	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
全体	平均値	119	111	0.76	0.76	28.8	33.0	71.2	43.3	33.9	8.8								
	中央値	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							
	標準偏差	42	48	0.01	0.01	1.9	1.3	1.6											
	範囲	170	95	0.76	0.76	28.8	38.2	33.0	71.2	43.3	33.9	8.8							

分析値一覧(第1層) O3A 厚層多量積層黒ボク土 土壌理化学性調査 第1期目:1979-1983年

土壌利用	項目	01 厚層土		02 5層土		03 0層土		04 0層土		05 表層土		06 表層土		07 表層土		08 表層土		09 表層土	
		(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
高層	平均値	43	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
中層	平均値	43	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
表層	平均値	43	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
全体	平均値	43	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						

分析値一覧(第1層) O3A 厚層多量積層黒ボク土 土壌理化学性調査 第1期目:1979-1983年

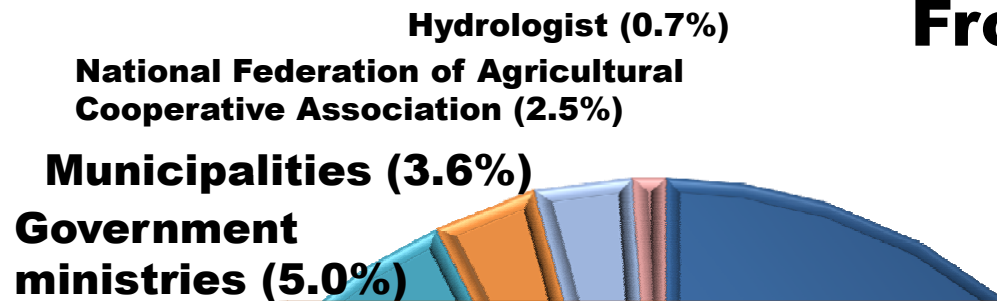
土壌利用	項目	01 厚層土		02 5層土		03 0層土		04 0層土		05 表層土		06 表層土		07 表層土		08 表層土		09 表層土	
		(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
高層	平均値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
中層	平均値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
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表層	平均値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
全体	平均値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	中央値	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						
	標準偏差	14	11	2.16	0.01	0.1	0.7	21.8	10.3	10.3	14.4	10.1	3.9						
	範囲	60	52	2.05	0.1	0.3	39	258	408	417	50.3	44.9	21.1						

1979-1983

1984-1988

1989-1993

Who are the users of soil information?



From Apr. 2010 to Jan. 2012

- **Total visits : 900,0000**
- **Main users have accessed in their office hours.**

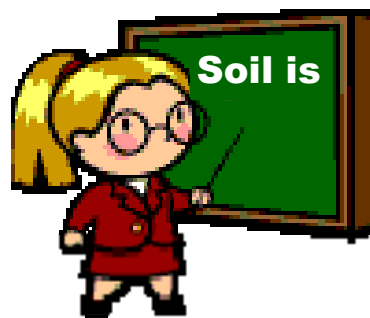
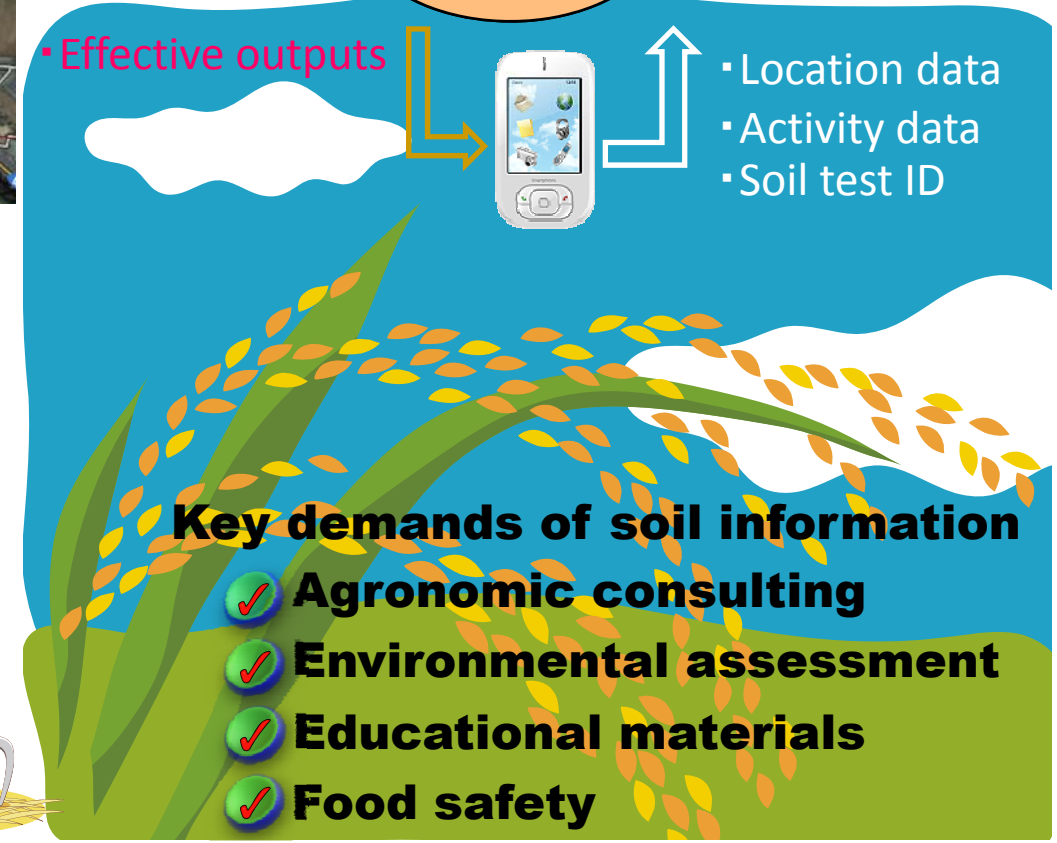
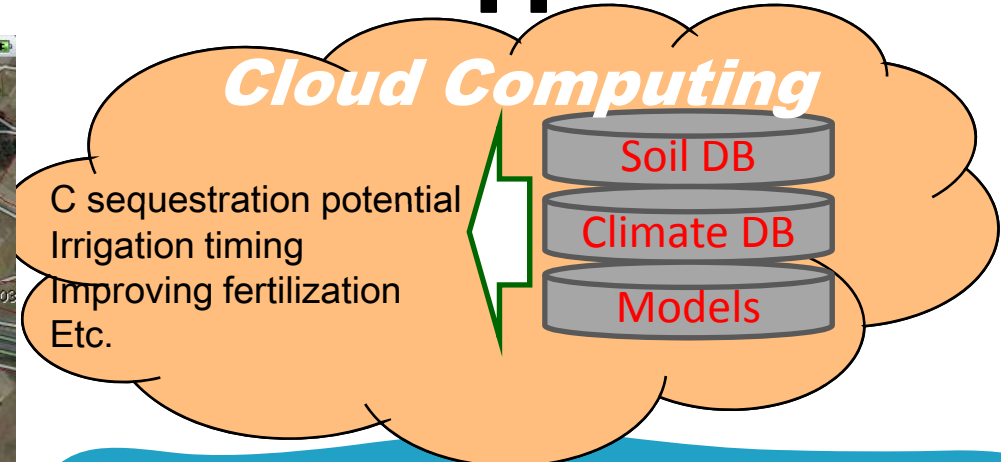
Key demands of soil information in Japanese agricultural land

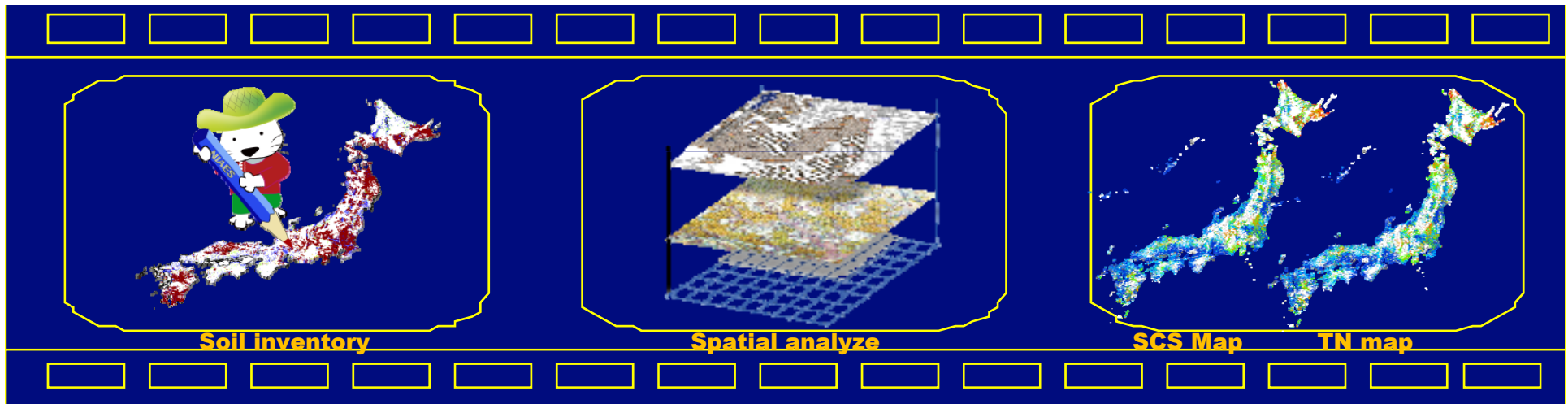
- ✔ **Agronomic consulting**
- ✔ **Environmental assessment**
- ✔ **Educational materials**
- ✔ **Food safety**

- (4) Chemicals**
- (5) Foodstuffs**

To link soil knowledge with sustainable soil management

Development phase for iPhone applications





Thank you very much for your attention.

I have been received a message from the administrative board of Japanese Society of Soil Science and Plant Nutrition



Japanese Society of Soil Science and Plant Nutrition

26-10-202, Hongo 6-chome, Bunkyo-ku, Tokyo, 113-0033 Japan

社団法人 日本土壤肥料学会

TEL +81-3-3815-2085 FAX +81-3-3815-6018 sfpoffice@jssspn.jp

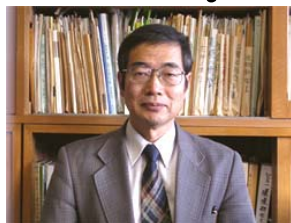
February 6th, 2012

Dear Prof. Renfang SHEN and All the Participants to International Conference
“Advancing the Science and Technology of Soil Information in Asia —
Launch of the Global Soil Partnership’ s Asia Soil Science Network and
GlobalSoilMap.net East Asia Node”:

The Japanese Society of Soil Science and Plant Nutrition is willing to join the
Asia Soil Science Network of the Global Soil Partnership. Congratulations
on the successful and fruitful conference !

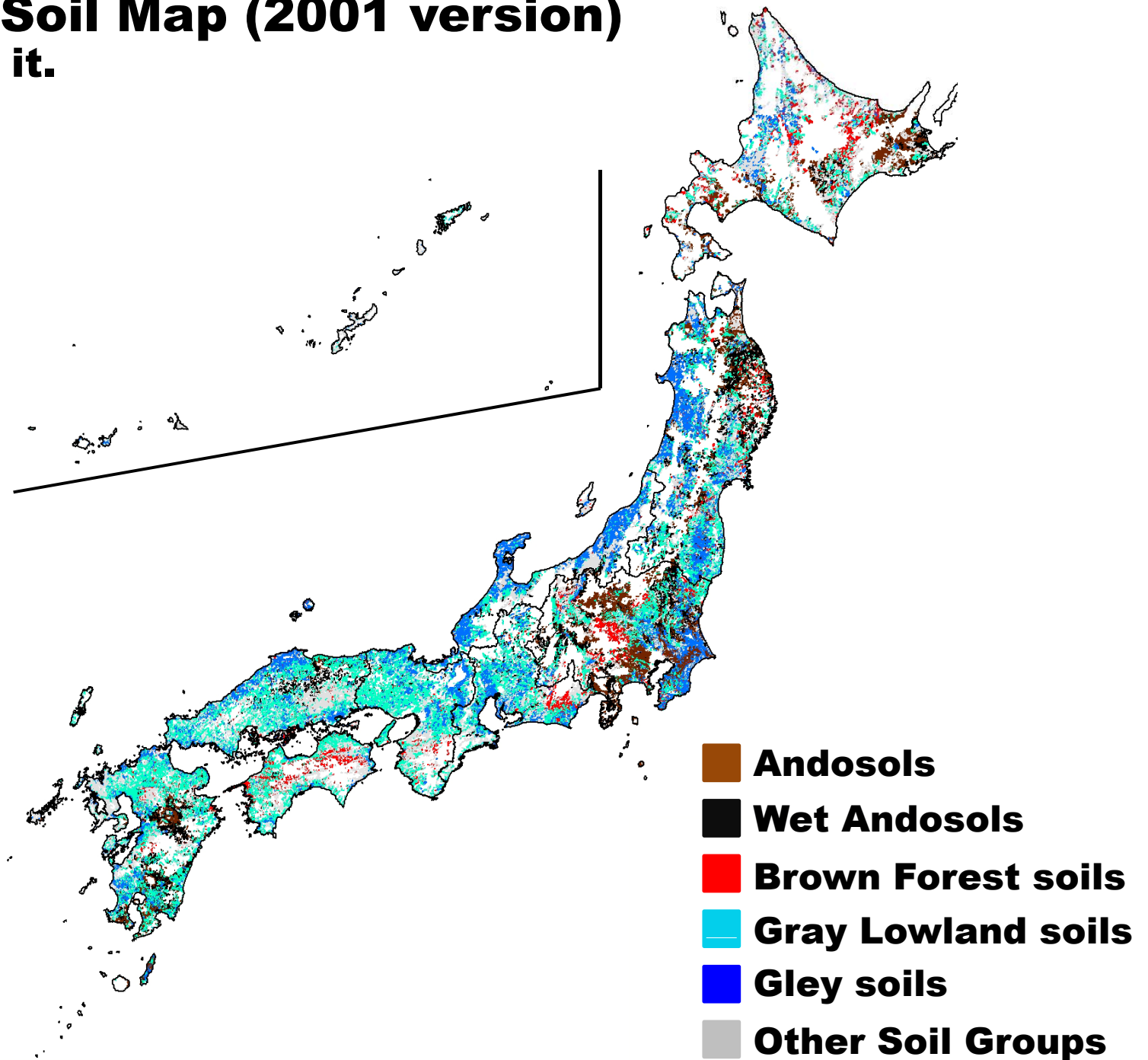
Very best wishes

M. Nanzyo, Chair of the Japanese Society of Soil Science and Plant Nutrition



Cultivated Soil Map (2001 version)

We are using it.



Temporal Variation of soil carbon and Nitrogen content (Tg) in Agricultural land

