

Field Form to Record IPY CiCAT Soil Data

Data input

The IPY CiCAT soil field data forms (see attached IPY CiCAT Soil Data Record) were designed to capture the minimum amount of data for the sample site and a morphological description of the soil (pedon). The data forms also include patterned ground classes, an important surface feature for characterizing the permafrost environment and permafrost-affected soils. A basic knowledge of pedology is needed to complete these forms. A general knowledge of geomorphology and wetlands is also needed. In addition, it is important that data be entered using the accepted standards and classifications. Entry of ambiguous information reduces or eliminates the usefulness of the data, especially if it is used for interpretation of the soil characteristics and analytical data. These forms and protocols should be used at least at the CiCAT “super sites” where basic soil descriptions from all major plant communities will be valuable information.

Method of describing and sampling

Soil profiles are exposed on vertical cuts in soil pits or trenches or in exposed sections along eroding rivers or lakeshores. The exposed soil profile (pedon) is described (Soil Classification Working Group, 1998) and soil samples are taken for chemical and physical analyses.

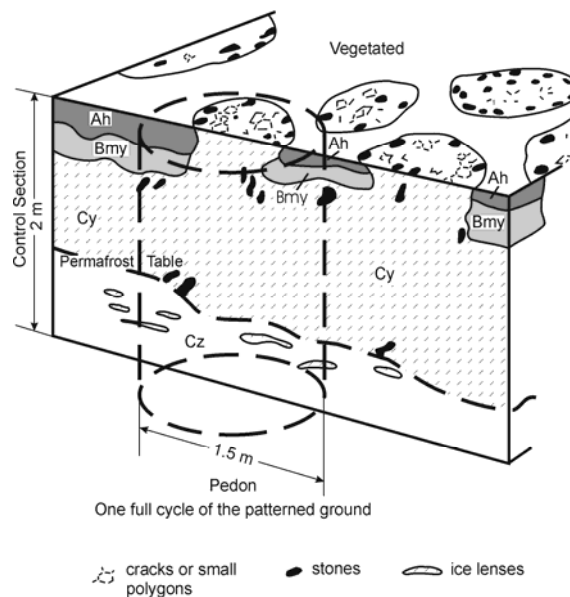


Figure 1. The pedon, delineated by a 1.5 m cylinder in this diagram, covers the full cycle of the nonsorted circle (Soil Classification Working Group, 1998).

Sampling and description of permafrost soils, especially those affected by cryoturbation, require special techniques. A trench or large pit (1 to 1.5 m wide and 1 m deep) is dug in order to expose a cross section of the soil profile. For Cryosolic soils with patterned

ground this is commonly the full cycle of the patterned ground (Figure 1). If the cryoturbated permafrost-affected soil is sampled for carbon content, the soil should be sampled to at least the 2 m depth. Descriptions of the site and of the soil horizons exposed on the trench wall are recorded on the IPY CiCAT Soil Data Record forms. The various soil horizons and other features should also be recorded on the soil profile diagram of this form and photographs of the soil profile and the surrounding landscape should be taken. Using this method, an experienced person can describe and sample two or three pedons in a day. Tools used for sampling frozen soils (both mineral and organic) are described in Tarnocai (1993) and tools used for sampling unfrozen organic soils (peatlands) are described in Sheppard et al. (1993).

Data entry

There are four ways to enter the data on this field form.

Self-defining entry: By circling an entry name. For example, if the soil is well drained, the well drained class in the drainage category should be circled.

Value and coded entry: By entering the numerical value or code in the data box or table. For example, the depth of thaw in centimeters is entered in the depth of thaw box or codes for describing the roots are entered in the horizon description table.

Written entry: By entering information in written form. For example, any important observations are written in the special notes box.

Graphical entry: By drawing a sketch of the soil profile on the soil profile diagram graph. The approximate scale should be included with this diagram. At this time photographs should be taken of both the soil profile and the surrounding landscape.

Definitions of classes

Definitions of the various classes and subclasses are found in the following publications:

Definitions of surface forms and parent material classes for mineral terrain: Canadian classification – Soil Classification Working Group (1998).

Definitions of peatlands and parent material classes for organic terrain: National Wetlands Working Group (1988).

Classes for stoniness, rockiness, bedrock, drainage and chemical component: Day (1983)

Descriptions of soil horizons and suffixes: Canadian classification – Soil Classification Working Group (1998).

Definition of patterned ground types: Washburn (1980)

Sample collection

Frozen and unfrozen bulk samples are collected from each horizon for chemical and physical analysis. Unfrozen samples are collected in the conventional way (Sheldrick 1984) and most CiCAT researchers will collect these types of samples. Frozen samples are collected with the aid of a power hammer or corer. Because of the ice contained in these samples, special containers and handling are required. If the samples contain moderate amounts of ice, they are usually placed in double, heavy-duty plastic bags. Both of these plastic bags should be sealed separately using waterproof ties or seals in order to avoid leakage. It is recommended that samples with high ice content be placed in plastic jars having waterproof caps. The water in these thawed soil samples quickly separates from the solids. It is important that this water not be discarded because this would result in the loss of nutrients and fine clay.

Frozen samples to be used for bulk density and ice content determinations are collected using a corer. After being measured (length and diameter), the cores are placed in watertight plastic jars.

Another method of collecting samples for bulk density determinations and micromorphological examinations is to dip a small frozen or unfrozen, undisturbed clod or section of the core in a saran-acetone solution (Natural Resources Conservation Service 1996). The clod, which should be approximately fist-sized and should be taken from the pit wall or the drill core, is placed in a hair net and dipped once or twice in the saran-acetone solution to coat the clod. The treated clod is then hung from a rope to dry using a clothespin. The saran coating dries relatively quickly and protects even frozen samples from breaking up, providing that they do not contain a high amount of ice. In that case the saran coating most likely will not be able to prevent the sample from breaking up. The treated clods are then placed in special cardboard containers to prevent disturbance during shipment.

Shipping and preparation

Although there is generally little possibility of drying the samples in the field, if facilities are available this is strongly recommended. The usual procedure, however, is for the various containers of bulk soil, thin section, and core samples to be placed in five-gallon metal sample pails for shipping. These sample containers should not be shipped in large canvas or plastic bags, since this method usually results in the rupture of the individual sample containers during shipping. The samples should be shipped by air to the laboratory as soon as possible. After the containers arrive they should be opened to allow the samples to dry. If wet samples remain in closed containers for a long period, reduction could occur with resultant transferral of components such as nitrates and iron oxides.

Soil analysis and available labs

The soil should be analysed by horizons. The minimum analytical data should include pH, nitrogen, organic carbon, CaCO₃ equivalent and particle size (total sand, silt and clay). A number of labs are available for soil analysis. The Soil and Nutrient Laboratory at the University of Guelph is commonly used. Attached is information on the types of analysis and the cost per sample. This material is also available at <http://www.uoguelph.ca/labserv/uniys/soil-nutrient/SNLprices.cfm>

References

- Day, J.H. (ed.) 1983. *The Canada Soil Information System (CanSIS) Manual for Describing Soils in the Field*. The Expert Committee on Soil Survey, Research Branch, Agriculture Canada, Ottawa, Canada. 166 p. (available at: http://res.agr.ca/cansis/publications/manuals/describing_soils.pdf)
- Natural Resources Conservation Service. 1996. Soil Survey Laboratory Methods Manual. Soil Survey Investigations Report No. 42, Version 3.0. United States Department of Agriculture, Washington D.C. 693 p.
- Sheldrick, B. H. 1984. Analytical Methods Manual. Land Resource Research Institute, Research Branch, Agriculture Canada, Ottawa. L.R.R.I. Contribution No. 84-30.
- Sheppard, M., C. Tarnocai and D.H. Thibault. 1993. Sampling organic soils. Chapter 42, p. 423–439 in: M.R. Carter (ed.), *Soil Sampling and Methods of Analysis*. Canadian Society of Soil Science. Lewis Publishers, Boca Raton, Florida.
- Soil Classification Working Group. 1998. *The Canadian System of Soil Classification*. 3rd ed. Agriculture and Agri-Food Canada Publication 1646, Ottawa. (available at: http://sis.agr.gc.ca/cansis/references/1998sc_a.html)
- Tarnocai, C. 1993. Sampling frozen soils. Chapter 71, p. 755–765 in: M.R. Carter (ed.), *Soil Sampling and Methods of Analysis*. Canadian Society of Soil Science. Lewis Publishers, Boca Raton, Florida.
- Washburn, A.L. 1980. *Geocryology*. John Wiley and Sons, New York. 406 p.
- National Wetlands Working Group, 1988. Wetlands of Canada. Ecological Land Classification Series, No. 24. Sustainable Development Branch, Environment Canada, Ottawa, Ontario, and Polyscience Publications Inc., Montreal, Quebec, 452 pp.

IPY CiCAT SOIL DATA RECORD

Site no. <input style="width: 95%;" type="text"/>	Site name <input style="width: 95%;" type="text"/>	Name of investigator <input style="width: 95%;" type="text"/>	Date (d/m/y) <input style="width: 95%;" type="text"/>	Name of geographical area <input style="width: 98%;" type="text"/>
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LANDFORM CLASSIFICATION

MINERAL TERRAIN SURFACE FORMS

- Blanket
- Delta
- Fan
- Hummocky
- Level
- Pitted
- Ridged
- Rolling
- Terrace
- Undulating
- Veneer
- Inclined

PARENT MATERIAL

(MINERAL SOILS)

- Fluvial
- Colluvial
- Eolian
- Fluvioeolian
- Fluviolacustrine
- Fluviomarine
- Glaciofluvial
- Glaciolacustrine
- Glaciomarine
- Lacustrine
- Lacustro-till
- Marine
- Morainal (till)
- Organic
- Residual

Elevation a.s.l. (m)

Location

Lat.	Long.
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DRAINAGE

- Very rapidly drained
- Rapidly drained
- Well drained
- Moderately well drained
- Imperfectly drained
- Poorly drained
- Very poorly drained

CHEMICAL COMPONENT

- Extremely/strongly acidic
- Medium acid/neutral
- Weakly calcareous
- Moderately/very strongly calcareous
- Extremely calcareous

SLOPE

SLOPE TYPE

- Simple
- Complex

SALINITY

LOCATION

- No salts visible
- Salts in deep subsoil
- Salts in upper C
- Salts in B
- Salts in A

ORGANIC TERRAIN (PEATLANDS)

- Bogs
 - With permafrost
 - Without permafrost
- Fens
 - With permafrost
 - Without permafrost
- Swamps
 - With permafrost
 - Without permafrost
- Marshes
 - With permafrost
 - Without permafrost

STONINESS

- Nonstony
- Slightly stony
- Moderately stony
- Very stony
- Exceedingly stony
- Excessively stony

SLOPE CLASS

%Slope	Class
0 to < 0.5	1
0.5 to < 2	2
2 to < 5	3
5 to < 9	4
9 to < 15	5
15 to < 30	6
30 to < 60	7
60+	8

ROCKINESS

- Nonrocky
- Slightly rocky
- Moderately rocky
- Very rocky
- Exceedingly rocky
- Excessively rocky

Percent Slope

PARENT MATERIAL

(ORGANIC PEAT SOILS)

- Sphagnum peat
- Sedge peat
- Brown moss sedge peat
- Woody peat
- Woody sedge peat
- Feather Moss peat
- Sedimentary peat
- Amorphous peat

BEDROCK

- Igneous
- Sedimentary
- Metamorphic
- Pyroclastic

SAMPLE SITE POSITION ON SLOPE

- Crest
- Upper slope
- Middle
- Lower slope
- Toe
- Depression

Depth to bedrock (cm)

Depth to watertable (cm)

Depth to impermeable layer (cm)

Depth of thaw (cm)

Estimated maximum thaw depth (cm)

Depth of rooting zone (cm)

Special Notes (free format)

CODES FOR HORIZON DESCRIPTION

HORIZONS

- D: lithological discontinuity
- Ma: master horizons (O,A,B,C)
- Suffix: suffixes
- M: modifier (B1,B2,B3)

HORIZON BOUNDARY (HB)

- S: smooth
- W: wavy
- I: irregular
- B: broken

COLOUR

Enter either Munsell colour

REDOXIMORPHIC FEATURES (RM)

- Y: visible
- N: not visible

ROOTS

SIZE (S)

- F: fine
- M: medium
- C: coarse

LOCATION (L)

- T: throughout
- A: matted on top of horizons
- N: in cracks

QUANTITY (Q)

- W: few
- O: common
- Y: many

COARSE FRAGMENTS (CF)

estimated value in %

HORIZON DESCRIPTION

#	HORIZONS				DEPTH		HB	COLOUR	RM	ROOTS			CF %	FIELD TEXTURE
	D	Ma	Suffix	M	Up	Low				S	L	Q		
1														
2														
3														
4														
5														
6														
7														
8														
9														

SOIL TEMPERATURE

Depth (cm):

C:

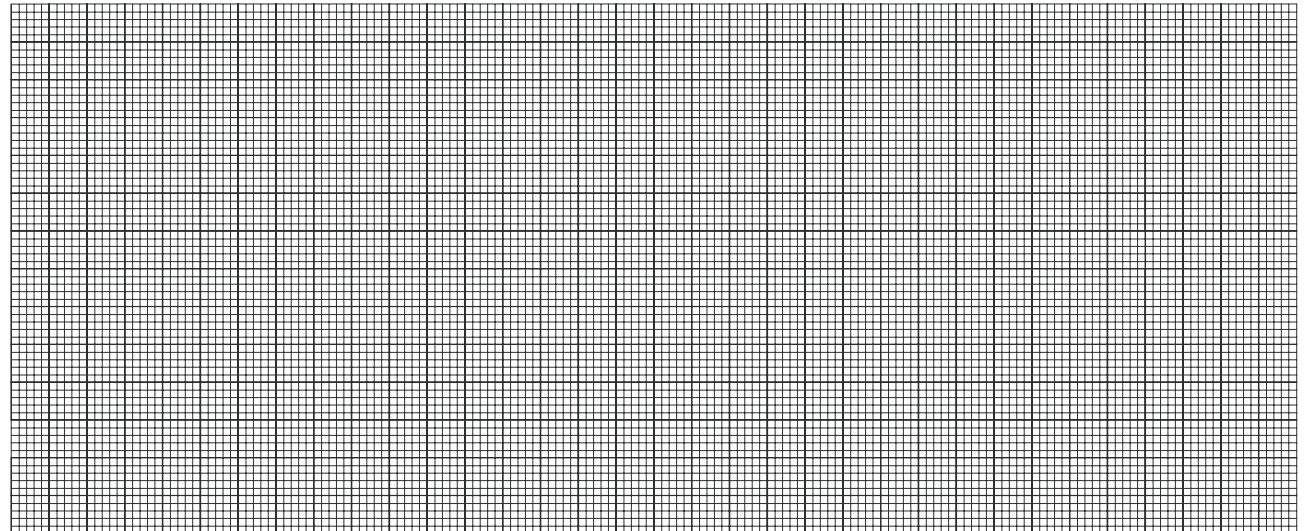
SOIL MOISTURE

Moisture %:

SOIL CLASSIFICATION

Canada:

SOIL PROFILE DIAGRAM



PATTERNED GROUND TYPE

- Sorted circle
- Sorted net
- Sorted stripe
- Sorted large polygon
- Sorted small polygon
- Nonsorted circle
- Nonsorted net
- Nonsorted stripe
- Nonsorted large polygon
- Nonsorted small polygon
- Earth hummocks
- Lowland (peat) polygon
- Polygonal peat plateau
- No pattern