

A GEOLOGICAL/GEOMORPHOLOGICAL AND SOIL TRANSECT STUDY
OF THE CHIRRIPO MASSIF AND ADJACENT AREAS,
CORDILLERA DE TALAMANCA, COSTA RICA

SEPARATE APPENDICES



J.G. van Uffelen

August, 1991

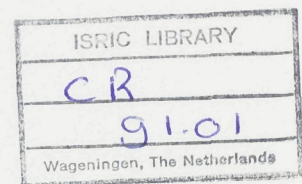
CENTRO AGRONOMO TROPICAL DE INVESTIGACION Y ENSEÑANZA
AGRICULTURAL UNIVERSITY WAGENINGEN
MINISTERIO DE AGRICULTURA Y GANADERIA DE COSTA RICA

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CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA
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10 Chemical and physical analyses of the soil profiles

I Information on the site:

- a. Profile number: 1.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Troposaprist.
FAO: Terric Histosol.
- d. Date of examination: 12 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: just south from a small lake which is situated in the south-western part of the 'Valle de las Morrenas' within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3500 m.
- h. Land form:
 - i. physiographic position of the site: small valley bottom (width of some 100 m) in a glacial landscape (groundmoraine).
 - ii. topography of surrounding country: hilly.
 - iii. microtopography: none.
- i. Slope on which profile is sited: flat (0%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature was 13.4 degrees Celcius at a depth of 10 cm. The soil temperature regime is isomesic

II General information on the soil:

- a. Parent material: drift mainly derived intrusive rock.
- b. Drainage: class 1 - poorly drained.
- c. Moisture conditions in the profile: profile wet throughout.
- d. Depth of groundwater table: 30 cm.
- e1. Presence of surface stones: stony (boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight water erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Very shallow very poorly drained black to very dark brown profile, 25 cm thick layer rich in sapric soil material (up to 43 % organic matter in the upper horizon). The profile is wet during the rainy season. Structure is weak subangular blocky in the upper part. Slightly sticky and slightly plastic throughout. There are few micro to fine pores and the biological activity is low. Only in the upper part one finds few fine roots.

IV Profile description:

- H1 25-15 Black (10YR 2/1) wet; loamy sand rich in sapric soil materials; weak medium subangular blocky; slightly sticky, slightly plastic; few micro vesicular pores; few fine roots; pH H2O 5.2; abrupt smooth boundary to:
- H2 15-7 Very dark brown (10YR 2/2) wet; sandy loam rich in

sapric soil materials (up to 28%); structureless; sticky, plastic; few very fine vesicular pores; pH H2O 5.2 ; abrupt smooth boundary to:
H3 7-0 Black (10YR 2/1) wet; sandy loam rich in sapric soil materials (up to 20%), very bouldery; structureless; slightly sticky, slightly plastic; few very fine vesicular pores; very frequent granite boulders, angular, fresh; few fine roots; pH H2O 5.5; overlying boulders and stones.

I Information on the site:

- a. Profile number: 2.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Acric Hapludand.
FAO: Histi-Haplic Andosol.
- d. Date of examination: 14 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: within the 'Valle de las Morrenas' 300 meters north-west of the hovel, within the 'Parque Nacional Chirripó'. East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3470 m.
- h. Land form:
 - i. physiographic position of the site: concave slope with a length of about 100 m just 200 m below the crest in a glacial landscape.
 - ii. topography of surrounding country: hilly.
 - iii. microtopography: none.
- i. Slope on which profile is sited: concave slope (18%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 10.9 degrees Celcius at a depth of 10 cm to 9.9 degrees Celsius at a depth of 40 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from intrusive rocks.
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile wet throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: stony (boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight water erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep imperfectly drained very dark brown to olive profile. An 13 cm thick horizon rich in sapric soil material overlies a loamy sand which contains very weathered gravel causing the presence of nodules and mottles. Structure is moderately subangular blocky in the upper part and weak in the lower part of the profile. Very few pores in the upper 50 cm of the profile and a normal root distribution. Relative high pH values (pH H2O 5.2-6.2).

IV Profile description:

- O/Ah 0-13 Very dark brown (10YR 2/2) wet; sandy loam rich in sapric soil materials; moderate fine subangular blocky; sticky, non plastic; common very fine vesicular pores; frequent very fine roots; pH H2O 5.2 ; gradual wavy

- boundary to:
- Ah 13-50 Dark yellowish brown (10YR 3/6) wet; sandy loam, gravelly; weak very fine subangular blocky; sticky, non plastic; few very fine vesicular pores; frequent granitic gravel, rounded, weathered; frequent small hard spherical yellow red iron nodules, as a result of the weathering of the gravel which results in common medium distinct clear, dark reddish brown (5YR) mottles; common medium roots; pH H2O 6.1; diffuse irregular boundary to:
- Bw 50-75 Olive (5Y 5/4) wet; few fine faint clear yellowish brown (10YR) mottles; sandy loam, gravelly and stony; weak very fine subangular; slightly sticky, non plastic; very frequent gravel (rounded and weathered), stones and boulders, angular, fresh; frequent small soft irregular, yellow iron nodules as a result of the weathering of the gravel; few coarse roots; pH H2O 6.0.

I Information on the site:

- a. Profile number: 3.
- b. Soil Name: -
- c. Higher Category Classification; USDA: Andic Dystropept.
FAO: Haplic Andosol.
- d. Date of examination: 15 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: western flank of the lower part of the 'Valle de las Morrenas' within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3365 m.
- h. Land form:
 - i. physiographic position of the site: lateral moraine with a straight slope of 77% (orientation of 76 degrees), in a glacial landscape
 - ii. topography of surrounding country: mountainous.
 - iii. microtopography: very small terraces with a width of 50 cm and a length of several meters.
- i. Slope on which profile is sited: very steep (77%).
- j. Land-use: high mountane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.4 degrees Celcius at a depth of 10 cm to 11.3 degrees Celsius at a depth of 30 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: bouldery drift mainly derived from intrusive rock.
- b. Drainage: class - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: very stony (stones, gravel and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight water erosion (rill).
- g. Presence of salt or alkali: none.
- h. Human influence: influenced by the big fire of 1976, which burned almost the trees growing on this lateral moraine.

III Brief description of the Profile:

Moderately deep well drained black to strong brown to pinkish gray profile. At the soil surface one finds a 1 cm thick layer of hemic soil material, in the upper part of the mineral soil material one finds charcoal as a result of the big fire of 1976. Texture varies between sandy loam and loamy sand. Gravel and stones throughout the profile, fresh and weathered (with mottles). Weak very fine subangular blocky in the upper part of the profile. In the upper part common very fine pores and common fine to medium roots, in the lower part few very fine pores and few medium roots. pH is relatively high (pH H₂O ranges from 6.2 to 6.5). Root distribution is normal. Very fine roots in the first 20 cm of the profile.

IV Profile description:

- O 1-0 Composed of well identifiable litter fragments with minor amounts of fine organic material; abrupt wavy boundary to:
- Ah 0-7 Black (10YR 2/1) moist; loamy sand, slightly gravelly; weak very fine subangular blocky; slightly sticky, non plastic, friable moist; common micro vesicular pores; very few gravel, angular, fresh and weathered resulting in residual nodules; common fine roots; pH H2O 6.2 ; clear wavy boundary to:
- Bw1 7-28 Strong brown (7.5YR 5/6) moist; sandy loam, slightly gravelly; many fine faint clear reddish yellow (7.5 YR) mottles; weak very fine subangular blocky; sticky, slightly plastic, friable moist; common very fine vesicular pores; very few angular gravel, fresh and weathered resulting in residual nodules with red mottles; common medium roots; pH H2O 6.5 ; gradual wavy boundary to:
- Bw2 28-100 Pinkish gray (5YR 6/2) to pink (5YR 7/4) moist; loamy sand, very stony; structureless; slightly sticky, non plastic, friable moist; few very fine vesicular pores; very frequent gravel and stones, angular and rounded, weathered resulting in nodules with red mottles; few medium roots; pH H2O 6.4.

I Information on the site:

- a. Profile number: 4.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Placaquand.
FAO: Andi-Umbic Leptosol.
- d. Date of examination: 24 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: in the upper part of the 'Valle de los Conejos'
within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago,
Costa Rica, Central America.
- g. Elevation: 3560 m.
- h. Land form:
 - i. physiographic position of the site: at almost flat valley
bottom, in a glacial landscape.
 - ii. topography of surrounding country: undulating.
 - iii. microtopography: none.
- i. Slope on which profile is sited: gently sloping (3%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature was 11.9 degrees Celcius at a depth of 10
cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from intrusive and sedimentary
rock.
- b. Drainage: class 0 - very poorly drained.
- c. Moisture conditions in the profile: profile wet throughout.
- d. Depth of groundwater table: not detected but there will be an
artificial water table above the iron pan during excessive rains.
- e1. Presence of surface stones: stony (gravel and stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: detected near the site, water erosion (sheet
erosion) of the soil material above the iron pan.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Very shallow very poorly drained black to dark brown profile. Loamy sand overlying a sandy loam both having a weak subangular blocky structure. Slightly sticky and slightly plastic throughout the profile. Common micro to very fine pores and common (very) fine roots. In the lower part one finds very frequent gravel with many yellowish mottles as a result of chemical weathering of gravel which results in residual nodules and water logging. The profile overlies a iron pan which has formed over an almost impermeable layer, formed by a abraded (rotten) rock surface. Relative high pH values (pH H2O 5.9-6.3).

IV Profile description:

Ah 0-9 Black (10YR 2/1) wet; loamy sand, weak fine subangular

blocky; slightly sticky, slightly plastic; common very fine vesicular pores; frequent very fine roots; pH H2O 5.9; clear smooth boundary to:

Ah/(E) 9-20 Dark yellowish brown (10YR 3/6) wet; sandy loam, very gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic; common micro vesicular pores; very frequent gravel, angular, weathered and very weathered which result in residual nodules with many medium distinct, clear, (5YR) 4/6 mottles; common fine roots; pH H2O 6.3; abrupt and smooth boundary to:

Bs 20-21 Thin iron pan no thicker than some 10 mm; continuous and nodular, formed over an abraded rock surface.

Moderately deep soil with a surface horizon of dark reddish brown loamy material and a subsoil horizon which contains fresh to very weathered stones and fragments of a thick layer of hemispherical material overlies the ground and weathered rounded gravel in the upper part. Weak subangular blocky structure, structureless in the lower part. Slightly sticky and plastic. In the upper part many, and in the lower part few roots. Soil distribution is normal. pH is relative high (pH H2O = 4.5 to 5.5).

IV Profile description

0 5-0 Composed of about equal amounts of more or less

I Information on the site:

- a. Profile number: 5.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Typic Hapludand.
FAO: Haplic Andosol.
- d. Date of examination: 17 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: 300 m north-east (down-valley) of the three hovels situated in the 'Valle de los Conejos', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3390 m.
- h. Land form:
 - i. physiographic position of the site: on a concave slope some 200 m below the crest in a glacial landscape.
 - ii. topography of surrounding country: mountainous.
 - iii. microtopography: none.
- i. Slope on which profile is situated: very steep (88%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.1 degrees Celcius at a depth of 10 cm to 9.8 degrees Celsius at a depth of 50 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from intrusive and sedimentary rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight water erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: in the upper parts of the profile one finds pieces of charcoal as relicts of the fire of 1976.

III Brief description of the Profile:

Moderately deep well drained profile consisting of dark reddish brown loamy material and yellowish brown loamy sand which contains fresh to very weathered stones and boulders. A 5 cm thick layer of hemic soil material overlies the mineral soil material. Rounded gravel in the upper part. Weak subangular blocky structure, structureless in the lower part. Slightly sticky and slightly plastic. In the upper part many, and in the lower part few pores. Root distribution is normal, pH is relative high (pH H₂O 6.4 to 6.2).

IV Profile description:

0 5-0 Composed of about equal amounts of more or less

- fragmented litter and finely divided organic material.
Abrupt wavy boundary to:
- Ah1 0-3 Black (10YR 2/1) moist; sandy loam, slightly gravelly; weak fine subangular blocky; slightly sticky, slightly plastic, friable moist; many very fine vesicular pores; pH H2O 6.4 ; clear wavy boundary to:
- Ah2 3-11 Dark brown (10YR 3/3) moist; loam, slightly gravelly; weak subangular blocky; slightly sticky, slightly plastic, friable moist; common very fine vesicular pores; very few rounded gravel and few residual nodules; pH H2O 6.4 ; clear wavy boundary to:
- Bw1 11-35 Reddish brown (5YR 4/3) moist; sandy loam, slightly gravelly; weak medium subangular blocky; slightly sticky, slightly plastic, friable moist; few fine vesicular pores; few rounded gravel and few residual nodules; pH H2O 6.3; gradual wavy boundary to:
- Bw2 35-60 Dark yellowish brown (10YR 3/6) moist; loamy sand, stony; weak medium subangular blocky; sticky, slightly plastic, friable moist; few medium vesicular pores; frequent angular stones; pH H2O 6.2; clear wavy boundary to:
- C 60-70 Light yellowish brown (10YR 6/4) moist; loamy sand, very stony; structureless; slightly sticky, non plastic, firm moist; very few stones, gravel and boulders, angular.

III Brief description of the Profile:

Moderately deep well drained soils. Black organic horizon rich in organic soil material overlies a dark reddish brown to dark yellowish brown loamy sand in which one finds angular gravel, stones and boulders, both fresh and weathered. Subangular blocky structure. Non sticky and non plastic in the upper part. Common very fine pores in the upper parts and few very fine pores in the lower parts. Few roots. Relative high pH values (pH H2O 6.3 to 6.3). In the lower part slightly nitroscopic.

IV Profile description:

I Information on the site:

- a. Profile number: 6.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Andic Eutropept.
FAO: Humi-Andi Eutric Regosol.
- d. Date of examination: 20 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: on the 'Fila Cementerio de la Máquina' just a ten minutes walk before reaching the three hovels situated in the 'Valle de los Conejos', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3340 m.
- h. Land form:
 - i. physiographic position of the site: straight slope formed by a lateral moraine in a glacial landscape.
 - ii. topography of surrounding country: mountainous.
 - iii. microtopography: none.
- i. Slope on which profile is sited: very steep (57%).
- j. Land-use: high montane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.6 degrees Celcius at a depth of 10 cm to 9.4 degrees Celsius at a depth of 40 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from sedimentary and volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: exceedingly stony (gravel, stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight rill erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: the area is influenced by the big fire of 1976, direct neighbourhood of the location of the soil profile was not influenced.

III Brief description of the Profile:

Moderately deep well drained soils. Black organic horizon rich in sapric soil material overlies a dark reddish brown to dark yellowish brown loamy sand in which one finds angular gravel, stones and boulders, both fresh and weathered. Subangular blocky structure. Non sticky and non plastic in the upper part. Common very fine pores in the upper parts and few very fine pores in the lower parts. Few roots. Relative high pH values (pH H₂O 6.3 to 6.5). In the lower part slightly tixotropic.

IV Profile description:

I. Information on the site:

- 0 3-0 Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Abrupt wavy boundary to:
- Ah 0-22 Dark reddish brown (5YR 3/4) moist; loamy sand, very stony; moderate medium subangular blocky; non sticky, non plastic, friable moist; common very fine vesicular pores; very frequent gravel and frequent stones, angular, fresh and weathered; common fine roots and few coarse roots; pH H2O 6.5; diffuse wavy boundary to:
- Bw1 22-57 Strong brown (7.5YR 5/6) moist; loamy sand, gravelly, stony and bouldery; weak medium subangular blocky; slightly tixotropic; non sticky, slightly plastic, friable moist; common very fine vesicular pores; few boulders, frequent stones and gravel angular, fresh and weathered with residual nodules; few fine to coarse roots; pH H2O 6.3; clear wavy boundary to:
- Bw2 57-67 Dark yellowish brown (10YR 3/4) moist; loamy sand, gravelly and very stony; weak medium subangular blocky; slightly tixotropic; slightly sticky, non plastic, friable moist; few very fine vesicular pores; frequent gravel and very frequent stones, angular, fresh and weathered resulting in residual nodules; very few fine roots.

The soil temperature was uniform (18.3 degrees Celsius) throughout the entire soil depth. The soil temperature regime is isomesic.

II. General information on the soil:

- a. Parent material: drift mainly derived from sedimentary and volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile was throughout (as a result of heavy rain).
- d. Depth of groundwater table: not determined.
- e. Frequency of surface stones: rather low (stones and boulders)
- f. Frequency of rock outcrops: none.
- g. Frequency of erosion: slight with stones.
- h. Frequency of salt or alkali: none.
- i. Frost influence: none.

IV. Profile description:

0 3-0 Composed of well identifiable litter fragments with

I Information on the site:

- a. Profile number: 7.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Typic Hapludand.
FAO: Umbric Andosol.
- d. Date of examination: 21 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: at left side of the 'Fila Cementerio de la Máquina', just a 40 minutes walk before reaching the three hovels situated in the 'Valle de los Conejos', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3250 m.
- h. Land form:
 - i. physiographic position of the site: straight slope of 66% (orientation of 54 degrees) in a glacial landscape.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: very steep (66%).
- j. Land-use: high montane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature was univorm (10.5 degrees Celcius) throughout the entire soil depth. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from sedimentary and volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile wet throughout (as a result of heavy rain).
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: rubble land (stones and boulders)
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight rill erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep well drained black to dark yellowish brown profile overlaid by an organic horizon rich in hemic soil material. Uniform in texture (loamy sand) with few to frequent gravel, stones and boulders, fresh and also weathered in the lower parts which results in the presence of residual nodules. Moderate to weak subangular blocky structure, non sticky and non plastic in the upper part of the profile. Fine and very fine pores and a normal root distribution. Relative high pH values (pH H₂O 6.3 to 6.4).

IV Profile description:

- 0 3-0 Composed of well identifiable litter fragments with

- minor amounts of fine organic materials. Abrupt wavy boundary to:
- Ah1 0-15 Black (10YR 2/1) wet; loamy sand, slightly gravelly, stony and bouldery; moderate medium subangular blocky; non sticky, non plastic; many very fine and few fine vesicular pores; frequent gravel and few stones, angular, fresh; very frequent fine roots; pH H2O 6.3; clear wavy boundary to:
- Ah2 15-40 Dark brown (10YR 3/3) wet; loamy sand, gravelly and very stony; weak medium subangular blocky; slightly tixotropic; non sticky, non plastic; common very fine vesicular pores; frequent gravel and few stones, angular and rounded, fresh and weathered with residual nodules; frequent fine, few medium to coarse roots; pH H2O 6.4; gradual wavy boundary to:
- Bw 40-60 Dark yellowish brown (10YR 3/4) wet; loamy sand, gravelly and very stony; weak medium subangular blocky; slightly tixotropic; slightly sticky, slightly plastic; few very fine vesicular pores; frequent stones and boulders, angular and rounded, fresh and weathered resulting in residual nodules; common medium roots.

I Information on the site:

- a. Profile number: 8.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Andic Eutropept.
FAO: Andi-Umbic Regosol.
- d. Date of examination: 22 September 1988.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Cementerio de la Máquina', just after passing the 'refugio natural', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3160 m.
- h. Land form:
 - i. physiographic position of the site: concave slope (44%, orientation of 88 degrees).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (44%).
- j. Land-use: high montane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.3 degrees Celcius at a depth of 10 cm to 10.4 degrees Celsius at a depth of 80 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift mainly derived from volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile wet throughout, as a result of heavy rains.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: exceedingly stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: there is some influence of the fire (1976) which is reflected in the small parts of charcoal found near the soil surface.

III Brief description of the Profile:

Moderately deep well drained black to brownish yellow profile. In the upper parts loamy sand and in the lower parts sandy loam. The mineral soil material is overlaid by a 5 cm thick horizon rich in hemic soil material. Within the profile one finds abundant gravel, stones and boulders. Structure is moderate to weak subangular blocky. Consistence when wet is slightly sticky and slightly plastic. Common micro to very fine vesicular pores throughout the profile, normal root distribution. Relative high pH values (pH H₂O 6.2 to 6.5).

IV Profile description:

- 01 3-0 Composed of well identifiable litter fragments with minor amounts of fine organic material; abrupt irregular boundary to:
- Ah1/02 0-10 Black (10YR 2/1) wet; loamy sand, gravelly, stony and bouldery; moderate medium subangular blocky; non sticky, slightly plastic; many very fine and few fine vesicular pores vesicular pores; very frequent boulders and frequent gravel and stones; common very fine to coarse roots; pH H2O 6.5; clear irregular boundary to:
- Ah2 10-45 Dark brown (10YR 3/3) wet; loamy sand, gravelly and stony; weak medium subangular blocky; slightly sticky, slightly plastic; common very fine and few fine vesicular pores; frequent gravel very weathered (which results in residual nodules), stones, few boulders, angular, fresh and weathered; common very fine to coarse roots; pH H2O 6.3; gradual irregular boundary to:
- Bw 45-60 Brownish yellow (10YR 6/8) wet; sandy loam, gravelly; weak fine subangular blocky; slightly sticky, slightly plastic; common micro to very fine vesicular pores; frequent very weathered gravel (residual nodules!), frequent stones angular and rounded, fresh and weathered; few fine to medium roots; pH H2O 6.2.

I Information on the site:

- a. Profile number: 9.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Alic Hapludand.
FAO: Humi-Umbric Regosol.
- d. Date of examination: 26 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: on left side of the 'Fila Cementerio de la Maquina' in the neighbourhood of the 'Monte Sin Fé', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3100 m.
- h. Land form:
 - i. physiographic position of the site: on gently convex slope near crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (18%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 8.7 degrees Celcius at a depth of 10 cm to 8.9 degrees Celsius at a depth of 30 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderate deep well drained dark brown to yellowish brown profile with a yellowish brown eluvial horizon containing some pure quartz grains. Mineral soil material is overlaid by a 10 cm thick layer of fibric to hemic organic soil materials. Podsolization! Structural development is weak, very fine crumb in the upper and subangular blocky in the upper and lower part, structureless in the eluvial horizon. Few vesicular pores, abundant roots in the organic soil material and very few in the eluvial horizon.

IV Profile description:

- 3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Clear and wavy boundary to:

- 01 7-0 Composed of about equal amounts of more or less fragmented litter and finely divided organic material, mineral grains are present. Very dark brown (10YR) moist; abundant very fine to medium roots; clear and wavy boundary to:
- E(Ah) 0-2 Yellowish brown (10YR 5/4) moist; sand; structureless; non sticky, non plastic, loose moist; very few medium roots; pH H2O 4.2; abrupt smooth boundary to:
- Bw1 2-8/14 Dark brown (10YR 4/3) moist; sandy loam, slightly gravelly; weak medium subangular blocky and weak very fine crumb; slightly sticky, slightly plastic, friable moist; common micro to fine vesicular pores; frequent, between angular and rounded, stones, weathered; common very fine to medium roots; pH H2O 4.4; clear wavy boundary to:
- 2Bw1 8/14-38 Dark yellowish brown (10YR 4/4) moist, yellowish brown (10YR 5/4) dry; few, fine, distinct, sharp, reddish yellow (7.5YR) mottles; loamy sand, slightly gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, friable moist; few micro and very fine vesicular pores; frequent stones, between angular and rounded, weathered; few fine to coarse roots; pH H2O 4.8; abrupt irregular boundary to:
- 2Bw2 38-43 Dark yellowish brown (10YR 4/6) moist; sandy loam, very gravelly and very stony; weak very fine angular blocky; sticky, plastic, firm moist, few macro and very fine vesicular pores; very frequent boulders, between angular and rounded, strongly weathered; very few to coarse roots.

10) Brief description of the profile:

Moderate deep, well drained (dark) yellowish brown to yellowish brown profile overlaid by a 10 cm thick layer of fibric to sapric organic soil material. Loamy sand with frequent gravel and a few stones, both weathered. Weak subangular blocky structure and also weak crumb structure in the upper part. Slightly sticky and slightly plastic throughout the profile. Micro to very fine pores, abundant roots in the organic soil material.

IV Profile description:

- 3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:
- 01 7-0 Dominantly composed of fine organic material, but with some litter fragments. Very dark brown (10YR 1/2) moist;

I Information on the site:

- a. Profile number: 10.
- b. Soil Name:
- c. Higher Category Classification;
USDA: (Histic) Andic Humitropept.
FAO: Humi-Andic Umbric Regosol.
- d. Date of examination: 26 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: on right side of the 'Fila Cementerio de la Maquina', a twenty minutes walk before reaching 'Monte Sin Fé', within the 'Parque Nacional Chirripó'.
- g. Elevation: 2910 m.
- h. Land form:
 - i. physiographic position of the site: on steep convex slope near crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (15%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.2 degrees Celcius at a depth of 10 cm to 9.9 degrees Celsius at a depth of 60 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock.
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 4 - exceedingly stony (gravel and stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: the physiographic position implies a risk for erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderate deep, well drained (dark) yellowish brown to yellowish brown profile overlaid by a 10 cm thick layer of fibric to sapric organic soil material. Loamy sand with frequent gravel and a few stones, both weathered. Weak subangular blocky structure and also weak crumb structure in the upper part. Slightly sticky and slightly plastic throughout the profile. Micro to very fine pores, abundant roots in the organic soil material.

IV Profile description:

- | | |
|--------|--|
| 3 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 7-0 | Dominantly composed of fine organic material, but with some litter fragments. Very dark brown (10YR 2/2) moist; |

abundant fine to medium roots; abrupt wavy boundary to:
 Ah 0-1/28 Dark yellowish brown (10YR 3/4) moist, brown (10YR 5/3)
 dry; loamy sand, gravelly and slightly stony; weak
 medium subangular blocky, weak crumb; slightly sticky,
 slightly plastic, very friable moist; many micro to very
 fine vesicular pores; frequent gravel, angular, weathe-
 red and few stones, angular, weathered; common fine to
 coarse and few very fine roots; pH H2O 5.0; abrupt wavy
 boundary to:
 Bw 1/28-53 Yellowish brown (10YR 5/6) moist, dark brown (10YR 4/3)
 dry; loamy sand, gravelly and slightly stony; weak
 medium subangular blocky; slightly sticky, slightly
 plastic, very friable; many micro to very fine pores;
 frequent gravel, angular weathered and few stones,
 angular, weathered; common fine to coarse roots; pH H2O
 5.1.

I Information on the site:

- a. Profile number: 11.
- b. Soil Name:
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Umbric Andosol.
- d. Date of examination: 26 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Cementerio de la Maquina', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2680 m.
- h. Land form:
 - i. physiographic position of the site: on convex slope near crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: very steep (88%)
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.3 degrees Celcius at a depth of 10 cm to 11.1 degrees Celsius at a depth of 30 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (gravel and stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: land slides in the direct neighbourhood.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep well drained black to olive yellow profile with a very dark grayish brown eluvial horizon overlaid by a 13 cm thick layer of fibric to sapric organic soil material. Podsolization! Loamy sand with an increase of gravel and stones to the lower part of the profile, weathered or very weathered. Structural development is weak. Sticky and plastic in the horizon underlying the eluvial horizon. Very fine and fine pores, abundant roots in the organic soil material.

IV Profile description:

- | | |
|---------|--|
| 3 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 10-5 | Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Abundant very fine to coarse roots; clear |

- wavy boundary to:
- 02 5-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Darkbrown (7.5YR) moist, dark gray (7.5YR 4/1) dry; abundant very fine to coarse roots; clear wavy boundary to:
- Ah/(E) 0-2/7 Very dark grayish brown (10YR 3/2) moist, very dark grayish brown (10YR 3/2) dry; loamy sand, slightly gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, very friable moist; few micro and very fine vesicular pores; few gravel, angular, strongly weathered; common very fine and fine roots; pH H2O 4.3; clear wavy boundary to:
- Ah/B 2/7-20 Black (10YR 2/1) moist; few, coarse, prominent, sharp very pale brown (10YR) and strong brown (7.5YR) mottles; loamy sand, slightly gravelly; weak very fine subangular blocky; sticky, plastic, friable moist; few micro and very fine vesicular pores; few gravel, angular, strongly weathered; few very fine and fine roots; pH H2O 4.0; clear irregular boundary to:
- Bw1 20-28/38 Dark yellowish brown (10YR 3/4) moist, brown (10YR 5/3) dry; common, coarse, prominent, sharp very pale brown (10YR) and strong brown (7.5YR) mottles; loamy sand, gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, very friable moist; common micro and very fine, few fine vesicular pores, frequent gravel, angular and rounded, strongly weathered; few very fine to coarse roots; pH H2O 4.8; clear irregular boundary to:
- Bw2 28/38-50/57 Strong brown (7.5YR) moist, yellowish brown (10YR 5/6) dry; few, coarse, distinct, clear very pale brown (10YR) and strong brown (7.5YR) mottles; loamy sand, gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, very friable moist; common micro and very fine vesicular pores; frequent gravel, angular and rounded, strongly weathered; few very fine and fine roots; pH H2O 4.9; clear irregular boundary to:
- C 50/57-110 Olive yellow (2.5Y 6/6) moist, very pale brown (10YR 7/3) dry; few coarse distinct, clear very pale brown (10YR) and strong brown (7.5YR) mottles; loamy sand, gravelly, weak very fine subangular blocky; slightly sticky, slightly plastic, friable moist; much micro and very fine and few fine vesicular pores; very frequent gravel, angular and rounded, strongly weathered and few stones, angular and rounded, weathered; few medium coarse roots; pH H2O 5.2.

I Information on the site:

- a. Profile number: 12.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Umbric Andosol.
- d. Date of examination: 25 march 1989.
- e. Author: J. G. van Uffelen.
- f. Location: on the right side of the 'Fila Cementerio de la Maquina',
within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago,
Costa Rica, Central America.
- g. Elevation: 2470 m.
- h. Land form:
 - i. physiographic position of the site: on crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (11%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 15.2 degrees Celcius at a depth
of 10 cm to 14.7 degrees Celsius at a depth of 50 cm. The soil
temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock (igneous altered lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (gravel, stones and
boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately wel drained (dark) reddish brown profile with a dark gray eluvial horizon overlaid by a 27 thick layer of fibric to sapric organic soil material. Podsolization! Loamy sand overlies a sandy loam containing frequent boulders. Structureless in the eluvial horizon and weak subangular structure in the lower part of the profile. Common very fine and fine pores. Abundant roots in the organic soil material and few in the eluvial horizon.

IV Profile description:

- | | |
|----------|---|
| 5 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Clear and wavy boundary to: |
| 01 22-12 | Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Dark reddish brown (5YR 3/3) dry; abundant, very fine to |

- coarse roots, clear wavy boundary to:
- 02 12-0 Dominantly composed of fine organic material, but with some litter fragments. Dark reddish brown (5YR 3/2) moist; abundant very fine to coarse roots, pH H2O 4.1; abrupt wavy boundary to:
- Ah/(E) 0-2 Dark gray (5YR 4/1) moist, very dark brown (10YR 2/2) dry; loamy sand, slightly gravelly and slightly stony; structureless; slightly sticky, slightly plastic, loose moist; few, medium to coarse roots; pH H2O 4.2; abrupt wavy boundary to:
- Ah/B 2-6/14 Dark reddish brown (5YR 3/3) moist, dark brown (10YR 3/3) dry; sandy loam, slightly gravelly and slightly stony; weak, very fine subangular blocky; sticky, plastic, firm moist; common micro and very fine vesicular pores; frequent gravel, between angular and rounded, weathered; common fine to coarse roots; pH H2O 5.1; clear irregular boundary to:
- Bw1 6/14-43 Dark yellowish brown (10YR 4/4) moist, dark yellowish brown (10YR 3/4) dry; sandy loam, bouldery; weak very fine subangular blocky; sticky, plastic; common micro and very fine vesicular pores; frequent boulders, angular, weathered; few fine to coarse roots; pH H2O 5.4.
- Bw2 43-48 Brown (10YR 4/4) moist, few, fine, faint, clear, dark reddish brown (10YR) mottles; sandy loam, bouldery; structureless, frequent boulders, angular weathered; few fine to coarse roots, pH H2O 5.4.

IV Profile Description

- 2 cm The litter is not fragmented, but slightly altered, evidenced by its partial or complete discoloration. Clear and wavy boundary to:
- 01 9-3 Composed of about equal amounts of more or less

I Information on the site:

- a. Profile number: 13.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Alic Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 27 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: at left side of the 'Fila Cementerio de la Maquina',
within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago,
Costa Rica, Central America.
- g. Elevation: 2300 m.
- h. Land form:
 - i. physiographic position of the site: on small crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (14%).
- j. Land-use: montane mixed oak forest of Q. Copeyensis and Q. Seemanni.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 13.7 degrees Celcius at a depth
of 10 cm to 13.7 degrees Celsius at a depth of 60 cm. The soil
temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none detected but the physiographic position
implies a risk for landslides.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderate deep well drained dark brown to brownish yellow profile with a dark gray eluvial horizon containing some pure quartz grains. The mineral soil material is overlaid by a 11 cm thick layer of fibric to sapric organic soil material. Podsolization! Structure is weakly developed: subangular blocky. Loamy sand overlying a sandy loam which contains very weathered gravel resulting in the presence of residual nodules. Common micro to very fine pores and few medium pores in the lower part. Abundant roots in the organic soil material and few in the eluvial horizon and the horizon immediately below.

IV Profile description:

- 2 cm The litter is non fragmented, but slightly altered,
evidenced by its partial or complete discoloration.
Clear and wavy boundary to:
- 01 9-5 Composed of about equal amounts of more or less

- fragmented litter and finely divided organic material. Common very fine to coarse roots; pH H2O 5.2; abrupt and wavy boundary to:
- O2 5-1 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5 YR) moist; abundant very fine to coarse roots; abrupt and smooth boundary to:
- O/E 1-0 Dark gray (10YR 4/1) moist; loamy sand; weak very fine subangular blocky; slightly sticky, slightly plastic, very friable moist; many micro, few very fine vesicular pores; few very fine to coarse roots; abrupt smooth boundary to:
- Ah/B 0-6 Dark brown (7.5YR 3/2) moist, very dark grayish brown (10YR 3/2) dry; common, medium, faint, clear, dark brown (7.5YR) mottles; loamy sand; weak very fine subangular blocky, slightly sticky, slightly plastic, very friable; common micro pores; few very fine to coarse roots; pH H2O 4.3; abrupt smooth boundary to:
- Bw1 6-34 Dark yellowish brown (10YR 4/6) moist, yellowish brown (10YR 5/6) dry; common, medium, faint, clear, dark brown (7.5YR) mottles; loamy sand; moderate very fine to medium subangular blocky; slightly sticky, slightly plastic, very friable moist; many micro, common very fine and few fine vesicular pores; very few gravel, angular, weathered and very few gravel (to a section of 2 cm) strongly weathered which results in the presence of residual nodules; common very fine to medium roots; pH H2O 4.8; gradual smooth boundary to:
- Bw2 34-54 Brownish yellow (10YR 6/8) moist; few, medium, faint, clear, dark yellowish brown (10YR) mottles; sandy loam, slightly gravely; weak very fine subangular blocky; sticky, plastic, firm moist; many micro, common very fine and fine, few medium vesicular pores; frequent gravel, angular, weathered and frequent gravel (to a section of two cm), strongly weathered; few medium roots; pH H2O 4.9.

III. Brief description of the Profile:

moderately deep, well drained dark brown profile overlaid by a 13 cm thick layer of fibric to sapric organic soil material. Loamy sand overlies a sandy loam containing stones and boulders weathered. Crush structure and in the lower part also subangular blocky. Mottles are probably a result of very weathered gravel (section of 2 cm) which have lost their original rock structure. Very fine to medium pores. Abundant roots in the organic soil material.

IV. Profile description:

- 5 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Clear and wavy boundary to:
- O1 0-4 Composed of about equal amounts of more or less fragmented litter and finely divided organic

I Information on the site:

- a. Profile number: 14.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Acric Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 27 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Cementerio de la Maquina', within the 'Parque Nacional Chirripó'.
East from the town of San Isidro, within the province of Cartago, Costa Rica, Cental America.
- g. Elevation: 2100 m.
- h. Land form:
 - i physiographic position: on small crest.
 - ii surrounding land form: steeply dissected.
 - iii microtopography: none.
- i. Slope on which profile is sited: sloping (12%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 18.7 degrees Celcius at a depth of 10 cm to 18.0 degrees Celsius at a depth of 50 cm. The soil temperature regime is isothermic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none detected but the physiographic position implies a risk for land slides.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep, well drained dark brown profile overlaid by a 13 cm thick layer of fibric to sapric organic soil material. Loamy sand overlies a sandy loam containing stones and boulders weathered. Crumb structure and in the lower part also subangular blocky. Mottles are probably a result of very weathered gravel (section of 2 cm) which have lost their original rock structure. Very fine to medium pores. Abundant roots in the organic soil material.

IV Profile description:

- | | |
|--------|--|
| 5 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
Clear and wavy boundary to: |
| 01 8-4 | Composed of about equal amounts of more or less fragmented litter and finely divided organic |

- material. Abundant very fine to fine roots: abrupt and wavy boundary to:
- 02 4-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5YR) moist; abundant very fine to medium roots; abrupt and wavy boundary to:
- Ah1 0-4 Black (10YR 2/1) moist, very dark brown (10YR 2/2) dry; loamy sand; moderate very fine crumb; slightly sticky, slightly plastic, very friable moist; common micro to very fine and few fine vesicular pores; many very fine to medium roots; pH H2O 5.0; clear irregular boundary to:
- Ah2 4-17/35 Dark brown (10YR 3/3) moist, dark yellowish brown (10YR 3/4); few fine, distinct, clear dark brown (7.5 Y/R) mottles; loamy sand, slightly gravelly; weak very fine crumb; slightly sticky, slightly plastic, friable moist; many micro, common very fine and few fine medium vesicular pores; few gravel between rounded and angular, weathered; common very fine to coarse roots; pH H2O 4.7; gradual irregular boundary to:
- Bw1 17/35-48 Yellowish brown (10YR 5/8) moist, brownish yellow (10YR 6/6) dry; common medium, faint, diffuse, reddish yellow (7.5 YR) mottles; sandy loam, stony; moderate fine and very fine crumb, weak very fine subangular blocky; sticky, plastic, friable moist; many micro and very fine pores, few fine and medium pores; frequent stones and boulders between rounded and angular, weathered; few very fine and fine, common medium to coarse roots; pH H2O 5.0.

III Brief description of the Profile

Moderately deep, well drained very dark brown to reddish yellow profile overlaid by a 7 cm thick layer of fibric and sapric organic soil material. Loamy sand overlies a sandy loam which contains weathered to very weathered stones. Settling is a result of very weathered gravel which already lost its rock structure. Moderate developed crumb in the upper and moderate subangular blocky structure in the lower part of the profile. Few micro to fine (vesicular) pores throughout the profile. Abundant roots in the organic soil material.

IV Profile description:

- 3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt and wavy boundary to:
- 02 4-0 Dominantly composed of fine organic material, free of

I Information on the site:

- a. Profile number: 15.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Andic Humitropept.
FAO: Humi-Andic Dystric Regosol.
- d. Date of examination: 29 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila cementerio de la Máguina', just outside the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1900 m.
- h. Land form:
 - i. physiographic position of the site: on crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (9%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 14.4 degrees Celcius at a depth of 10 cm to 14.6 degrees Celsius at a depth of 30 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 1 - fairly stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: the physiographic position implies a risk for erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep, well drained very dark brown to reddish yellow profile overlaid by a 7 cm thick layer of fibric and sapric organic soil material. Loamy sand overlies a sandy loam which contains weathered to very weathered stones. Mottling is a result of very weathered gravel which already lost its rock structure. Moderate developed crumb in the upper and moderate subangular blocky structure in the lower part of the profile. Few micro to fine (vesicular) pores throughout the profile. Abundant roots in the organic soil material.

IV Profile description:

- | | |
|--------|--|
| 3 cm | The litter is non fragmentend, but slightly altered, evidenced by its partial or complete discoloration.
Abrupt and wavy boundary to: |
| 01 4-0 | Dominantly composed of fine organic material, free of |

- litter fragments, but mineral grains are present. Dark brown (10YR) moist; abrupt wavy boundary to:
- O/Ah1 0-5 Very dark brown (10YR 2/2) moist; loamy sand; weak to moderate very fine crumb; slightly sticky, slightly plastic, very friable moist; common very fine vesicular pores; abundant very fine to coarse roots; pH H2O 4.2; abrupt wavy boundary to:
- Ah2 5-11 Dark brown (10YR 4/3) moist and dry; loamy sand; common, fine, prominent, yellow (10YR) to black (10YR) mottles; weak very fine to medium crumb; slightly sticky, slightly plastic, very friable moist; few micro to fine vesicular pores; common fine to coarse roots; pH H2O 4.7; abrupt wavy boundary to:
- Bw1 11-36 Yellowish brown (10YR 5/8) moist, yellowish brown (10YR 5/6) dry; common, fine, prominent, yellow (10YR) to black (10YR) mottles; sandy loam; moderate very fine subangular blocky; slightly sticky, slightly plastic, very friable moist; few very fine vesicular pores; few fine to coarse roots; pH H2O 5.0; gradual wavy boundary to:
- Bw2 36-46 Reddish yellow (7.5YR 6/8) moist, reddish yellow (7.5YR 6/8) dry; common, fine, prominent, sharp very pale brown (10YR) to very dark brown (10YR) mottles; sandy loam, slightly stony; weak very fine subangular blocky; sticky, plastic, friable moist; few very fine vesicular pores; frequent stones, between rounded and angular, weathered and strongly weathered; pH H2O 5.0.

III Brief description of the profile

Shallow moderately well drained dark brown to yellowish brown profile overlaid by a 7 cm thick layer of fibrous and humic organic soil material. Sandy loam containing weathered to very weathered gravel and stones. Moderate to weak subangular structure. Slightly sticky and slightly plastic in the upper part. Few to common very fine pores. Only very fine roots in the upper part of the soil profile. The whole profile was compacted (as a result of human activity,??)

IV Profile description:

3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.

I Information on the site:

- a. Profile number: 16.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Haplumbrept.
FAO: Umbric Regosol.
- d. Date of examination: 29 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Fila Cementerio de la Mágua' to the 'Valle de los Crestones', outside the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1700 m.
- h. Land form:
 - i. physiographic position of the site: on crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (44%).
- j. Land-use: submontane secondary forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 16.0 degrees Celcius at a depth of 10 cm to 15.7 degrees Celsius at a depth of 20 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 3 - moderately well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (stones and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: the physiographic position implies a risk for erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: the forest was cleared some five years ago, and this probably resulted in a compaction of the soil. After clearance there was no further human influence.

III Brief description of the Profile:

Shallow moderately well drained dark brown to yellowish brown profile overlaid by a 7 cm thick layer of fibric and humic organic soil material. Sandy loam containing weathered to very weathered gravel and stones. Moderate to weak subangular structure. Slightly sticky and slightly plastic in the upper part. Few to common very fine pores. Only very fine roots in the upper part of the soil profile. The whole profile was compacted (as a result of human activity(?))

IV Profile description:

5 cm	The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
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01 2-0 Abrupt and wavy boundary to:
 Composed of about equal amounts of more or less fragmented litter and finely divided organic material, but mineral grains are present. Dark brown (10YR) with parts of charcoal; common very fine and fine roots; abrupt wavy boundary to:

Ah 0-28 Dark brown (10YR 3/3) moist, dark yellowish brown (10YR 4/4) dry; sandy loam, slightly gravelly; moderately very fine subangular blocky; slightly sticky, slightly plastic, friable moist; many micro and few fine vesicular pores; very few gravel, rounded, weathered and very weathered causing very pale brown mottles; very few fine roots; pH H2O 4.8; gradual wavy boundary to:

Bw1 28-38 Yellowish brown (10YR 5/8) moist, strong brown (7.5YR 5/6); sandy loam, slightly gravelly and slightly stony; weak very fine subangular blocky; sticky, plastic, firm moist, common very fine vesicular pores; frequent gravel and stones, rounded, weathered and very weathered causing very pale brown mottles; very few fine roots; pH H2O 5.1.

I Information on the site:

- a. Profile number: 17.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 1 april 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Palmito Morado' just before the limits of the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2100 m.
- h. Land form:
 - i. physiographic position of the site: on small crest with a width of about 10 meters.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (22%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 8.8 degrees Celcius at a depth of 10 cm to 7.7 degrees Celsius at a depth of 50 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 1 - fairly stony (gravel and stones)
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: land slides near the soil pit.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow well drained dark yellowish brown to brownish yellow profile with a thin pale brown eluvial horizon, overlaid by a 15 cm thick layer of fibric to sapric soil material. Podsolization! Loamy sand containing very weathered gravel, causing mottles in the lower part. Slightly sticky and slightly plastic throughout the profile. Few micro to very few pores to common fine and few medium in the lower part of the profile. Abundant roots in the organic soil material.

IV Profile description:

- 3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
Abrupt wavy boundary to:
- 01 12-8 Composed of about equal amounts of more or less

- fragmented litter and finely divided organic material. Dark brown (7.5YR) moist; abundant fine to medium roots; abrupt wavy boundary to;
- O2 8-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5YR) moist; common very fine to coarse roots, abrupt smooth boundary to;
- Ah1/(E) 0-2 Pale brown (10YR 6/3) moist; loamy sand; moderate very fine subangular blocky; slightly sticky, slightly plastic, friable moist; few micro and few very fine vesicular pores; few very fine and fine roots; pH H2O 4.2; abrupt wavy boundary to;
- Ah2 2-20 Dark yellowish brown (10YR 4/4) moist and dry (10YR 4/3); few, fine, faint, clear yellowish red (5YR) mottles; loamy sand, slightly gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, very friable moist, few micro and very fine vesicular pores; few gravel, angular, strongly weathered; common fine to coarse roots; pH H2O 4.8; abrupt wavy boundary to;
- Bw 20-33 Brownish yellow (10YR 6/6) moist, very pale brown (10YR 8/4); few, fine, faint, clear, reddish yellow (7.5 YR) mottles; loamy sand, slightly gravelly; weak very fine subangular blocky; slightly sticky, slightly plastic, friable moist; many micro to very fine pores and common fine and few medium vesicular pores; few gravel, angular, strongly weathered; few fine to coarse roots; pH H2O 5.1.

III Brief description of the profile

Well drained, moderately deep dark brown to yellowish brown profile overlaid by a 10 cm thick layer of fibric to sapric organic soil material. Loamy sand to silt loam containing very weathered gravel causing some mottles in the lower part of the profile. Structural development is weak subangular blocky. Slightly sticky and slightly plastic throughout the profile. Few micro and very fine pores. Abundant very fine to coarse roots in the organic material and few in the Ah horizon, root distribution in the lower part of the profile is normal.

IV Profile description

- 3 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to;
- 01 15-10 Composed of about equal amounts of more or less

I Information on the site:

- a. Profile number: 18.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Acric Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 31 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Palmito Morado', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2300 m.
- h. Land form:
 - i. physiographic position of the site: on steep convex slope (88%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (22%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.9 degrees Celcius at a depth of 10 cm to 10.7 degrees Celsius at a depth of cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: intrusive rock (granodiorite).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: fairly stony (gravel and stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: land slides detected near the soil pit.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Well drained, moderately deep dark brown to yellowish brown profile, overlaid by a 20 cm thick layer of fibric to sapric organic soil material. Loamy sand to silt loam containing very weathered gravel causing some mottles in the lower part of the profile. Structural development is weak subangular blocky. Slightly sticky and slightly plastic throughout the profile. Few micro and very fine pores. Abundant very fine to coarse roots in the organic material and few in the Ah horizon, root distribution in the lower part of the profile is normal.

IV Profile description:

- | | |
|----------|---|
| 3 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
Abrupt wavy boundary to: |
| 01 18-10 | Composed of about equal amounts of more or less |

- fragmented litter and finely divided organic material. Very dark grayish brown (10YR) moist, abundant very fine to fine roots; abrupt and wavy boundary to:
- O2 10-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are presents. Dark brown (7.5YR) moist very dark grayish brown (10YR 3/2) dry; abundant very fine to coarse roots; abrupt wavy boundary to:
- O/Ah1 0-3 Very dark brown (10YR 3/2) moist, dark gray (10YR 4/1) dry; loamy sand; weak very fine subangular blocky; slightly sticky, slightly plastic, firm moist; few micro vesicular pores; very few gravel (section of 3 cm), rounded, very weathered; few very fine to coarse roots; pH H2O 4.2; abrupt wavy boundary to:
- Ah2 3-8 Dark yellowish brown (10YR 3/4) moist, dark yellowish brown (10YR 3/4) dry; sandy loam, slightly gravelly (section of 2 cm); weak very fine subangular blocky; slightly sticky, slightly plastic, firm moist; common micro and few very fine vesicular pores; very few gravel, rounded, very weathered, pinkish gray (7.5 YR); common very fine to coarse roots; pH H2O 4.6; clear irregular boundary to:
- Bw 8-62 Yellowish brown (10YR 5/6) moist, very pale brown (10YR 3/7) dry; few, fine, faint, clear, strong brown (7.5YR) mottles, silt loam, slightly gravelly to gravelly; weak very fine subangular blocky, slightly sticky, slightly plastic, firm moist; few micro vesicular pores; frequent gravel and stones, angular, weathered, common very fine to coarse roots; pH H2O 5.0.

Soil description of profile

moderately deep, well drained, very dark brown to pale brown profile overlaid by a 20 cm thick layer of organic soil material. One finds a weak developed eluvial horizon in loamy sand, containing some very weathered gravel, over a sandy loam rich in gravel, stones and boulders, partly very weathered causing some mottling. Structure is weak subangular blocky. Slightly sticky and slightly plastic. Few micro pores except for the eluvial horizon which has few micro to medium pores. Abundant roots in the lower parts of the organic soil material.

IV Profile description:

5 cm The litter is not fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:

I Information on the site:

- a. Profile number: 19.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Acric Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 31 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Fila Palmito Morado', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2500 m.
- h. Land form:
 - i. physiographic position of the site: on crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (14%).
- j. Land-use: montane lauraraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.

The soil temperature ranged from 10.2 degrees Celcius at a depth of 10 cm to 10.6 degrees Celsius at a depth of cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock (lava)
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 1 - fairly stony (gravel and stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep, well drained, very dark brown to pale brown profile overlaid by a 20 cm thick layer fibric to sapric organic soil material. One finds a weak developed eluvial horizon in loamy sand, containing some very weathered gravel, over a sandy loam rich in gravel, stones and boulders, partly very weathered causing some mottling. Structure is weak subangular blocky. Slightly sticky and slightly plastic. Few micro pores except for the eluvial horizon witch has few micro to medium pores. Abundant roots in the lower parts of the organic soil material.

IV Profile description:

- 5 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
Abrupt wavy boundary to:

- 01 15-9 Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Dark brown (7.5YR) moist; common very fine to medium roots; clear wavy boundary to:
- 02 9-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5 YR) moist; abundant fine to coarse roots; abrupt wavy boundary to:
- O/Ah1 0-2 Very dark brown (10YR 2/2) moist, dark brown (10YR 4/3) dry; loamy sand; weak subangular blocky; slightly sticky, slightly plastic, very friable moist; many micro to very fine and common fine to medium vesicular pores; few gravel, angular, weathered or very weathered; common fine to medium roots; pH H2O 4.4; abrupt wavy boundary to:
- Ah2 2-8 Dark brown (10YR 4/3) moist; common, coarse, faint, clear, dark brown (7.5YR) mottles; sandy loam, slightly gravelly; weak subangular blocky; slightly sticky, slightly plastic, very friable moist; few micro vesicular pores; few gravel (0.5-2 cm), angular, weathered or very weathered; few fine to medium and few coarse roots; pH H2O 4.5; abrupt wavy boundary to:
- Ah3/Bw 8-43 Pale brown (10YR 6/3) moist, yellowish brown (10YR 5/4) dry; few fine to coarse, prominent, sharp brownish yellow mottles (10YR); sandy loam, very gravelly and very stony; weak subangular blocky; slightly sticky, slightly plastic, very friable moist; few micro vesicular pores; frequent gravel (0.5-2 cm), stones and boulders, angular and rounded, weathered; few medium to coarse roots; pH H2O 5.2.

I Information on the site:

- a. Profile number: 20.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Umbric Andosol.
- d. Date of examination: 31 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on the right side of the 'Fila Palmito Morado' to the 'Fila Urán', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2700 m.
- h. Land form:
 - i. physiographic position of the site: on relative broad crest (50 meters broad).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (7%).
- j. Land-use: montane mixed oak forest of Q. Copeyeensis and Q. Seemanni
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.5 degrees Celcius at a depth of 10 cm to 10.2 degrees Celsius at a depth of 50 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock (lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow well drained very dark brown to dark yellowish brown profile with a dark gray eluvial horizon overlaid by a 20 cm thick layer of fibric to sapric organic material. Podsolization! Loamy sand to sandy loam containing weathered boulders. Structural development is moderate to weak subangular blocky. Micro to very fine pores. Abundant roots in the organic soil material, very few in the eluvial horizon.

IV Profile description:

- 2 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:
- 01 18-15 Composed of well identifiable litter fragments with

- minor amounts of fine organic material. Abundant very fine to medium roots abrupt wavy boundary to:
- 02 15-10 Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Dark brown (7.5YR) moist; abundant very fine to medium roots; clear wavy boundary to:
- 03 10-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5YR) moist; frequent very fine to coarse roots; abrupt smooth boundary to:
- Ah1/(E) 0-6 Dark gray (10YR 4/1) moist; loamy sand; moderate very fine subangular blocky; slightly sticky, slightly plastic, firm moist; few micro vesicular pores; very few very fine to coarse roots; pH H2O 4.1; abrupt smooth boundary to:
- Ah2 6-12 Very dark brown (10YR 2/2) moist, dark gray (10YR 4/1) dry; sandy loam; weak very fine subangular blocky; sticky, plastic, firm moist; common micro and few very fine vesicular pores; common very fine to coarse roots; pH H2O 4.5; clear wavy boundary to:
- Ah3 12-32 Dark yellowish brown (10YR 3/4) moist and dry, very dark grayish brown (10YR 3/2) dry; sandy loam, stony and boulderly; weak very fine subangular blocky; sticky, plastic, firm moist; common micro and few very fine vesicular pores; very frequent boulders, rounded, weathered; few very fine to coarse roots; pH H2O 5.0.

II. General information on the soil

- a. Parent material: alluvial material, derived from volcanic rock (lava)
- b. Drainage: class 4 - well drained
- c. Moisture conditions in the profile: soil moist throughout
- d. Depth of groundwater table: not detected
- e. Presence of surface stones: class 1 - few to many
- f. Presence of rock outcrops: none
- g. Evidence of erosion: none
- h. Presence of salt or alkali: none
- i. human influence: none

III. Brief description of the profile

Moderately deep well drained very dark brown to brownish yellow profile with a substratum of rotten volcanic rock and overlies a 3 cm thick layer of sapric organic soil material. Very fine subangular blocky. Sandy loam over a loamy sand with weathered stones and rotten rock with common red and gray mottles. Slightly sticky and slightly plastic except for the substratum. Micro and very fine pores. Root distribution normal with abundant roots in the organic soil material.

IV. Profile description:

- O 0-5 Dominantly composed of fine organic material, free of litter fragments, but mineral grains present; very dark brown (10YR 2/2) moist; abundant very fine to coarse roots; gradual wavy boundary to:
- Ah 0-15 Very dark brown (10YR 2/2) moist, very dark grayish

I Information on the site:

- a. Profile number: 21.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Andic Humitropept.
FAO: Humi-Andi Dystric Regosol.
- d. Date of examination: 1 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on the 'Fila Palmito Morado', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2900 m.
- h. Land form:
 - i. physiographic position of the site: on gently convex slope.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (12%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 10.4 degrees Celcius at a depth of 10 cm to 10.0 degrees Celsius at a depth of 70 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluviul material derived from volcanic rock (lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 1 - fairly stony (stones).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep well drained very dark brown to brownish yellow profile with a substratum of rotten volcanic rock and overlies a 5 cm thick layer of sapric organic soil material. Very fine subangular blocky. Sandy loam over a loamy sand with weathered stones and rotten rock with common red and gray mottles. Slightly sticky and slightly plastic except for the substratum. Micro and very fine pores. Root distribution normal with abundant roots in the organic soil material.

IV Profile description:

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|----|------|---|
| O | 5-0 | Dominantly composed of fine organic material, free of litter fragments, but mineral grains present; very dark brown (10YR 2/2) moist; abundant very fine to coarse roots; gradual wavy boundary to: |
| Ah | 0-18 | Very dark brown (10YR 2/2) moist, very dark grayish |

brown 10YR 3/2) dry; sandy loam, slightly gravelly; moderate very fine subangular blocky; slightly sticky, slightly plastic, friable moist; very few rounded stones, weathered; common micro vesicular pores; abundant very fine to coarse roots; pH H2O 5.0; gradual wavy boundary to:
 Ah/Bw1 18-45 Dark yellowish brown (10YR 4/6) moist, brownish yellow (10YR 6/6) dry; loamy sand, slightly gravelly; moderate subangular blocky; slightly sticky, slightly plastic, friable moist; very few rounded stones, weathered; common very fine vesicular pores; few fine to medium roots; pH H2O 4.7; clear wavy boundary to:
 Bw2 45-60 Brownish yellow (10YR 6/6) moist, very pale brown (10YR 8/3) dry; loamy sand, slightly stony; weak subangular blocky; slightly sticky, slightly plastic, friable moist; very few rounded stones, weathered; few micro vesicular pores; few medium roots; pH H2O 4.9; clear wavy boundary to:
 Bw3 60-75 Pale yellow (5Y 7/4) moist, white (2.5Y 8/2) dry; structureless; nonsticky, non plastic, friable moist; few micro vesicular pores; few medium roots; pH H2O 4.9.

III. Brief description of the profile:

Moderately deep, well drained, clayey, brown to dark yellowish brown profile. 10 cm thick layer of organic soil material. Loamy sand overlies a sandy loam containing very frequent fresh gravel and stones. Medium granular and subangular blocky structure, structureless in the Bw2 horizon. Slightly sticky, slightly plastic to sticky and plastic. Common to few micro (vesicular) pores. Abundant roots in the organic soil material.

IV. Profile description:

O 10-0 Dominantly composed of thin organic material, free of litter fragments, but mineral grains are present. Very dark brown (10YR 2/1) moist, dark gray (10YR 4/2) dry, abundant very fine to medium roots; pH H2O 5.5; gradual

I Information on the site:

- a. Profile number: 22.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 1 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Palmito Morado', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3000 m.
- h. Land form:
 - i. physiographic position of the site: on steep concave slope.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (44%).
- j. Land-use: montane pure oak forest of Q. Costarisencis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.5 degrees Celcius at a depth of 10 cm to 9.2 degrees Celsius at a depth of 40 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock (lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: class 2 - stony (gravel, stones and boulder).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: non detected, but physiographic position implies risk for erosion (land slides).
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep, well drained, dark brown to dark yellowish brown profile, 10 cm thick layer of sapric organic soil material. Loamy sand overlies a sandy loam containing very frequent fresh gravel and stones. Medium granular and subangular blocky structure, structureless in the Bw2 horizon. Slightly sticky, slightly plastic to sticky and plastic. Common to few micro (vesicular) pores. Abundant roots in the organic soil material.

IV Profile description:

- | | | |
|---|------|--|
| 0 | 10-0 | Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Very dark brown (10YR2/2) moist, dark gray (10YR 4/2) dry, abundant very fine to medium roots; pH H2O 4.8; gradual |
|---|------|--|

- wavy boundary to:
- Ah 0-5 Dark brown (10YR 3/3) moist, brown (10YR 5/3) dry; loamy sand, slightly gravelly; moderate medium granular; slightly sticky, slightly plastic, firm when moist; common, micro vesicular pores; few gravel, angular, weathered; abundant fine to coarse roots; pH H2O 4.8; abrupt wavy boundary to:
- Ah/Bw1 5-40 Dark yellowish brown (10YR 4/4) moist, yellowish brown (10YR 5/6) dry; loamy sand, slightly gravelly; weak subangular blocky; slightly sticky, slightly plastic, friable; common micro vesicular pores; few gravel, angular, weathered; common fine to coarse roots; pH H2O 5.0; gradual wavy boundary to:
- Bw2 40-55 Dark yellowish brown (10YR 4/6) moist, brownish yellow (10YR 6/6) dry; sandy loam, very gravelly, very stony; structureless; sticky, plastic, firm moist; few micro vesicular pores; very frequent gravel and stones, angular, fresh; very few medium to coarse roots; pH H2O 4.9.

Slope on which profile was made: _____

Parent material: _____

Drainage class: _____

Molting conditions in the field: _____

Depth of groundwater table: _____

Temperature regime: _____

IV. General information on the soil

- Parent material: volcanic ash
 - Drainage class: imperfectly drained
 - Molting conditions in the field: none
 - Depth of groundwater table: none
- Excessive rain there will be a slight iron pan
- Presence of surface stones: none
 - Presence of rock outcrops: none
 - Evidence of erosion: none
 - Presence of salt or alkali: none
 - Human influence: none

III. Brief description of the profile

Shallow, imperfectly drained very dark gray to black dark brown profile, with an dark gray aluvial horizon 1-2 cm thick layer of sapric organic soil material. In the lower part of the profile a thin iron pan has been formed over a yellow horizon. Heavy sand overlies a sandy loam both of which are strongly weathered gravel causing slight swelling above the iron pan. Moderate subangular blocky, structureless in the B horizon. Roots are concentrated in the organic soil material and in the upper part of the aluvial horizon.

IV. Profile description:

0 15-0 Dominantly composed of organic material (mainly

I Information on the site:

- a. Profile number: 23.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Lithic Placudand.
FAO: Humi-Umbric Andosol.
- d. Date of examination: 1 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Fila Palmito Morado' near the 'Paso de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3100 m.
- h. Land form:
 - i. physiographic position of the site: on a very small plateau near the 'Fila Urán', at the border of the glacial landscape.
 - ii. topography of surrounding country: hilly.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (11%).
- j. Land-use: high montane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.4 degrees Celcius at a depth of 10 cm to 9.1 degrees Celsius at a depth of 50 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: soil moist throughout.
- d. Depth of groundwater table: not detected, but after periods of excessive rain there will be a superficial water layer over the thin iron pan.
- e1. Presence of surface stones: very stony (gravel).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow, imperfectly drained very dark grayish to very dark brown profile, with an dark gray eluvial horizon formed beneath a 15 cm thick layer of sapric organic soil material. Podsolization! In the lower part of the profile a thin iron pan has been formed over a yellow C horizon. Loamy sand overlies a sandy loam both containing some strongly weathered gravel causing clear mottling above the iron pan. Moderate subangular blocky, structureless in the C horizon. Roots are concentrated in the organic soil material and in the upper part of the eluvial horizon.

IV Profile description:

0 15-0 Dominantly composed of organic material (mainly

- consisting of sphagnum fibers), but with some litter fragments. Abundant very fine to medium roots. Abrupt and wavy boundary to:
- Ah1/(E1) 0-8 Dark gray (5YR 4/1) moist, dark gray (10YR 4/1) dry; loamy sand, slightly gravelly; moderate medium to coarse subangular blocky; slightly sticky, slightly plastic, firm moist; few very fine vesicular pores; very few gravel (0.2-2 cm), angular strongly weathered with few, medium, distinct, clear orange mottles; common very fine to coarse roots; pH H2O 4.1; clear wavy boundary to:
- Ah2/(E2) 8-28 Very dark grayish brown (10YR 3/2) moist, dark brown (10YR 3/3) dry; sandy loam, gravelly; structureless; sticky, plastic, very firm moist, common very fine vesicular pores; few gravel (0.2-2 cm), between angular and rounded, strongly weathered with many fine distinct clear orange and brown mottles; few medium pores; pH H2O 4.7; clear irregular boundary to:
- Ah3 28-34 Very dark brown (10YR 2/2) moist, dark brown (10YR 3/3) dry; sandy loam, gravelly; weak medium subangular blocky; sticky, plastic, firm moist; common very fine vesicular pores; few gravel, between angular and rounded, strongly weathered with common fine distinct clear orange and brown mottles; few medium pores; pH H2O 4.8; abrupt smooth boundary to:
- Bs 34-35 Thin iron pan; hardened with iron; possible to break it by hand; continuous; material has sponge like structure; abrupt and smooth boundary to:
- C 35-50 Yellow (10YR 7/8) moist, very pale brown (10YR 8/4) dry; sandy loam, gravelly; structureless; sticky, plastic, very firm moist; few gravel, between angular and rounded, strongly weathered; pH H2O 5.2.

III Brief description of the profile

Shallow imperfectly drained black to brown profile having an organic volcanic rock. A 38 centimeter thick layer rich in aspic organic soil material overlies the mineral soil material. Leavy caps over a sandy loam containing some very weathered gravel causing wotling. Structural development is weak subangular blocky. Slightly sticky and slightly plastic throughout the profile. Many micro pores in the sapric material and less below this soil material. Common very fine and fine roots in the upper 40 cm of the profile.

IV Profile description:

I Information on the site:

- a. Profile number: 24.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Troposaprist.
FAO: Terric Histosol.
- d. Date of examination: 28 Februari 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Paso de los Indios' near the 'Cerro Urán', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3250 m.
- h. Land form:
 - i. physiographic position of the site: on a small convex slope in a glacial landscape.
 - ii. topography of surrounding country: hilly.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (20%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 10.9 degrees Celcius at a depth of 10 cm to 10.0 degrees Celsius at a depth of 40 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift derived from volcanic rock and volcanic rock in situ (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: wet throughout, especially at the lower parts.
- d. Depth of groundwater table: not detected, but after periods of excessive rain there will be a water layer over the rotten volcanic rock.
- e1. Presence of surface stones: exceedingly stony (boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: slight water erosion.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow imperfectly drained black to brown profile resting on rotten volcanic rock. A 38 centimeter thick layer rich in sapric organic soil material overlies the mineral soil material. Loamy sand over a sandy loam containing some very weathered gravel causing mottling. Structural development is weak subangular blocky. Slightly sticky and slightly plastic throughout the profile. Many micro pores in the sapric material and less below this soil material. Common very fine and fine roots in the upper 40 cm of the profile.

IV Profile description:

- 0 38-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Black (10YR2/1) wet, very dark gray (10YR 3/1) dry; loamy sand; structureless; slightly plastic and slightly sticky; many micro (vesicular) pores; common very fine and fine roots; abrupt irregular boundary to:
- Ah1 0-3 Black (10YR 2/1) wet, dark brown (10YR 3/3) dry; loamy sand, weak fine subangular blocky; slightly plastic and slightly sticky; few micro and very fine pores; common very fine and fine roots; pH H2O 4.5; clear wavy boundary to:
- Ah2 3-14 Brown (10YR 4/4) wet and (10YR 5/3) dry; sandy loam, slightly gravelly, stony; weak very fine subangular blocky; few micro and very fine pores; frequent gravel (0-2 cm) rounded and very weathered causing some mottling; few very fine and fine roots; pH H2O 4.7; resting on rotten volcanic rock.

- Parent material: ...
- Drainage class: ...
- Moisture conditions: ...
- depth of groundwater table: ...
- excessive rain there is ...
- presence of surface stones: ...
- presence of rock outcrops: ...
- evidence of erosion: ...
- presence of salt or alkali: ...
- human influence: none

III Brief description of the Profile

Shallow imperfectly drained black to very pale brown profile overlaid by a 22 cm thick black horizon rich in organic soil material. The B horizon consists of rotten volcanic rock. Developed in a loamy sand containing frequent gravel which is partly very weathered causing mottling. Slightly sticky, slightly plastic to non sticky and non plastic. Structural development is very weak subangular blocky to structureless. Micro pores in the upper part and common roots in the organic soil material.

IV Profile description:

I Information on the site:

- a. Profile number: 25.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Lithic Humitropept.
FAO: Humi-Dystric Regosol.
- d. Date of examination: 2 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Paso de los Indios' near the 'Cerro Urán', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3300 m.
- h. Land form:
 - i. physiographic position of the site: on a concave slope near a small hill top in a glacial landscape.
 - ii. topography of surrounding country: hilly.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (40%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.0 degrees Celcius at a depth of 10 cm to 10.0 degrees Celsius at a depth of 20 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: moist above the iron pan, dry below.
- d. Depth of groundwater table: not detected, but after periods of excessive rain there will be influence of groundwater on the profile.
- e1. Presence of surface stones: exceedingly stony (boulders to a cross-section of 3 m).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow imperfectly drained black to very pale brown profile overlaid by a 22 cm thick black horizon rich in sapric soil material. The BC horizon consists of rotten volcanic rock. Developed in a loamy sand containing frequent gravel which is partly very weathered causing mottles. Slightly sticky, slightly plastic to non sticky and non plastic. Structural development is very weak subangular blocky to structureless. Micro pores in the upper part and common roots in the organic soil material.

IV Profile description:

- O/Ah 0-22 Black (10YR 2/1) wet, very dark gray (10YR 3/1) dry; loamy sand rich in sapric soil material; weak subangular blocky to structureless; slightly sticky, slightly plastic; few micro vesicular pores; common very fine to fine, few medium roots; pH H2O 4.6; gradual wavy boundary to:
- Ah/(E) 22-34 Dark brown (10YR 3/3) moist, gray (10YR 5/1) dry; common fine distinct clear very pale brown (10YR) to brownish yellow (10YR) mottles; loamy sand, gravelly; weak subangular blocky; slightly sticky, slightly plastic; few micro vesicular pores; frequent gravel, angular, weathered and strongly weathered; few very fine to fine roots; pH H2O 5.1; abrupt irregular boundary to:
- Bs 34-35 Thin iron pan formed over a substratum of rotten rock; possible to break it by hand; continuous; material has sponge like structure and vesicular pores; clear wavy boundary or gradual wavy boundary to:
- BC 35-45 Very pale brown (10YR 8/4) to brownish yellow (10YR 6/8) moist, pale yellow (2.5Y 8/4) dry; many medium distinct, diffuse clear very pale brown (10YR) to brownish yellow (10YR) mottles; loamy sand, structureless; non sticky, non plastic; stony and bouldery, very strongly weathered rotten rock; pH H2O 5.5.

- a. Parent material: colluvium (lava)
- b. Drainage class: Ustic
- c. Moisture conditions in the profile: ustic
- d. Depth of groundwater table: 100 cm
- e1. Presence of surface stones: none
- e2. Presence of rock outcrops: none
- f. Evidence of erosion: none
- g. Presence of salt or alkali: none
- h. Human influence: none

III Brief description of the profile

Moderately deep imperfectly drained, Ustic, yellowish brown profile with a 59 cm thick layer of dark brown soil material overlying the horizon rich in sapric soil material. Weak subangular blocky in the A horizon. Subangular to angular in the B horizon. Slightly sticky, slightly plastic. Common very fine and very fine pores in the upper part of the profile. Common very fine to fine roots in the upper 30 cm of the profile.

IV Profile description:

- 01 35-40 Dark brown (10YR 3/3) moist, gray (10YR 5/1) dry; common fine distinct clear very pale brown (10YR) to brownish yellow (10YR) mottles; loamy sand, gravelly; weak subangular blocky; slightly sticky, slightly plastic; frequent gravel, angular, weathered and strongly weathered; few very fine to fine roots; pH H2O 5.1; abrupt irregular boundary to:

I Information on the site:

- a. Profile number: 26.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Troposaprist.
FAO: Terric Histosol.
- d. Date of examination: 3 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Paso de los Indios' near the 'Cerro Urán', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3250 m.
- h. Land form:
 - i. physiographic position of the site: relative broad crest in glacial landscape.
 - ii. topography of surrounding country: mountainous.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (18%).
- j. Land-use: bamboo-páramo.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 8.8 degrees Celcius at a depth of 10 cm to 8.6 degrees Celsius at a depth of 50 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile wet throughout.
- d. Depth of groundwater table: at 25 cm.
- e1. Presence of surface stones: stony - boulders.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep imperfectly drained black to light yellowish brown profile with a 59 cm thick layer rich in sapric organic soil material overlying the horizons rich in mineral material. Moderate subangular blocky in the B horizons. Structureless in the lower part of the profile. Slightly sticky, slightly plastic throughout. Very common to common fine and very fine pores in the mineral part except for the lower part. Common very fine to medium roots in the upper 65 cm of the profile.

IV Profile description:

- | | | |
|----|-------|--|
| 01 | 55-40 | Dark brown (10YR 3/3) wet; loamy sand rich in sapric soil material; structureless; slightly sticky, slightly plastic; abundant, very fine to |
|----|-------|--|

		medium roots; clear wavy boundary to:
02	40-25	Very dark brown (10YR 2/2) wet and dry; loamy sand rich in sapric soil material; weak very fine subangular blocky; slightly sticky, slightly plastic; many very fine vesicular pores; common very fine to medium roots; clear wavy boundary to:
03	25-0	Black (10YR 2/1) wet and dry; loamy sand, slightly gravelly rich in sapric soil material; weak very fine subangular blocky, slightly sticky, slightly plastic; very common very fine vesicular pores; few gravel (5-7.5 cm) rounded, weathered; common very fine to medium roots; pH H2O 4.5; clear wavy boundary to:
Ah	0-10/20	Dark brown (10YR 3/3) wet, very dark grayish brown (10YR 3/2); loamy sand, slightly gravelly; moderate very fine subangular blocky; slightly sticky, slightly plastic; common fine vesicular pores; few gravel (5-7.5 cm) rounded, weathered; common very fine to medium roots; pH H2O 4.6; clear irregular boundary to:
Bw	10/20-30	Light yellowish brown (10YR 6/4) wet; common to coarse, distinct, diffuse, yellowish brown (10YR) mottles; sandy loam, stony and bouldery; structureless; slightly sticky, slightly plastic; frequent boulders, rounded, strongly weathered.

- General characteristics of the soil:
- a. Parent material: drift derived from volcanic rock and volcanic ash in situ (lava)
 - b. Drainage: class 3, moderately well drained
 - c. Moisture conditions in the profile: wet throughout
 - d. Depth of groundwater table: not detected, but the profile will be influenced by groundwater after periods of excessive rain
 - e1. Presence of surface stones: none
 - e2. Presence of rock outcrops: none
 - f. Evidence of erosion: none
 - g. Presence of salt or alkali: none
 - h. Human influence: none

III Brief description of the Profile:

Moderately deep and moderately well drained black to yellowish brown profile overlaid by a 23 cm thick layer of fibric to sapric organic soil material. Some small parts of charcoal (0.5-2.0 cm) were found in the upper part of the organic soil material. Sandy loam, containing some weathered gravel, overlies rotten volcanic rock. Slightly sticky and slightly plastic throughout the profile. Common micro (vesicular) pores to a depth of some 70 cm. Common very fine to medium roots in the organic soil material, fewer roots in the mineral part of the profile.

IV Profile description:

01 61-58 Composed of well identifiable litter fragments with minor amounts of fine organic material. Abrupt wavy

I Information on the site:

- a. Profile number: 27.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Troposaprist.
FAO: Terric Histosol.
- d. Date of examination: 3 March 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Paso de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 3100 m.
- h. Land form:
 - i. physiographic position of the site: on crest in glacial landscape.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (11%).
- j. Land-use: high montane dwarf forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 9.2 degrees Celcius at a depth of 10 cm to 9.0 degrees Celsius at a depth of 70 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: drift derived from volcanic rock and volcanic rock in situ (lava).
- b. Drainage: class 3 - moderately well drained.
- c. Moisture conditions in the profile: wet throughout
- d. Depth of groundwater table: not detected, but the profile will be influenced by groundwater after periods of excessive rain.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep and moderately well drained black to yellowish brown profile overlaid by a 23 cm thick layer of fibric to sapric organic soil material. Some small parts of charcoal (0.5-2.0 cm) were found in the upper part of the organic soil material. Sandy loam, containing some weathered gravel, overlies rotten volcanic rock. Slightly sticky and slightly plastic throughout the profile. Common micro (vesicular) pores to a depth of some 70 cm. Common very fine to medium roots in the organic soil material, fewer roots in the mineral part of the profile.

IV Profile description:

- | | | |
|----|-------|---|
| 01 | 61-58 | Composed of well identifiable litter fragments with minor amounts of fine organic material. Abrupt wavy |
|----|-------|---|

- boundary to:
- 02 58-45 Dominantly composed of fine organic material, but with some litter fragments. Dark reddish brown (5YR) wet; slightly sticky, slightly plastic; many micro to very fine vesicular pores; abundant very fine to medium roots; clear wavy boundary to:
- 03 45-38 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Black (10YR 2/1) wet; slightly sticky, slightly wet; common micro vesicular pores; common very fine to fine and few medium roots; clear wavy boundary to;
- 04 38-20 Black (10YR 2/1) wet; sandy loam; weak subangular blocky; slightly sticky, slightly plastic; common micro vesicular pores; common very fine to fine and few coarse roots; pH H2O 4.2; clear wavy boundary to:
- 05 20-0 Very dark brown (10YR 2/2) wet; sandy loam, slightly gravelly; weak subangular blocky; slightly sticky, slightly plastic; common, micro vesicular pores; very few rounded weathered granite; common very fine to fine and few coarse roots; pH H2O 4.5; clear wavy boundary to:
- Ah/Bw 0-12/26 Brown (10YR 5/3) wet and dry (7.5YR 5/2); common, medium, distinct, clear brown (10YR) to very dark brown (10YR) mottles; sandy loam, slightly gravelly; weak very fine angular blocky; slightly sticky, slightly plastic; common micro vesicular pores; very frequent gravel (0.5-2.0 cm), angular, strongly weathered volcanic rock; few very fine to fine roots; pH H2O 4.6; clear irregular boundary to:
- BwC 12/26-32 Light yellowish brown (10YR 6/4) moist, very pale brown (10YR 7/4) dry; many medium to coarse prominent sharp brownish yellow (10YR) to strong brown (7.5YR) mottles; rotten rock with patches of sandy loam; structureless; pH H2O 4.7.

- e1 Presence of surface stones: none.
- e2 Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profiles:

Moderate deep, imperfectly drained dark brown to brownish yellow profiles with an iron pan formed over rotten volcanic rock. A 43 cm thick layer of fibric to sapric organic soil material overlies the mineral soil material. Sandy clay loam over a sandy loam resting on the rotten rock. Weakly developed aluvial horizon above the iron pan which is continuous and can be broken by hand. Many micro to fine pores in the sapric soil material and common micro above the iron pan. Abundant roots in the sapric soil material.

IV Profile description:

I Information on the site:

- a. Profile number: 28.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: Lithic Troposaprist.
FAO: Terric Histosol.
- d. Date of examination: 6 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2900 m.
- h. Land form:
 - i. physiographic position of the site: on small crest with a width of several meters at the border of the glacial landscape.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (16%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature was almost univorm (8.9 degrees Celsius) throughout the entire soil depth. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile wet above the iron pan, moist below.
- d. Depth of groundwater table: not detected, but after periods of excessive rain a water layer above the iron pan will influence the profile.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderate deep, imperfectly drained dark brown to brownish yellow profile with an iron pan formed over rotten volcanic rock. A 43 cm thick layer of fibric to sapric organic soil material overlies the mineral soil material. Sandy clay loam over a sandy loam resting on the rotten rock. Weakly developed eluvial horizon above the iron pan which is continuous and can be broken by hand. Many micro to fine pores in the sapric soil material and common micro above the iron pan. Abundant roots in the sapric soil material.

IV Profile description:

- 01 43-38 Composed of well identifiable litter fragments with minor amounts of fine organic material. Abrupt wavy boundary to:
- 02 38-20 Dominantly composed of fine organic material, but with some litter fragments, but mineral grains present; very dark grayish brown (10YR) wet, very dark brown (10YR 2/2) dry; non sticky, slightly plastic; many micro to fine vesicular pores; abundant fine roots; pH H2O 4.4; gradual wavy boundary to:
- 03 20-0 Dominantly composed of fine organic material, free of litter fragment, mineral grains present; very dark brown (10YR) wet; slightly sticky, slightly plastic; many micro to very fine vesicular pores; abundant fine to coarse roots; pH(H2O) 3.9; clear wavy boundary to:
- Ah1/(E1) 0-15 Dark brown (10YR 4/3) wet, gray (10YR 6/1) dry; sandy clay loam; moderate very fine subangular blocky; slightly sticky, slightly plastic; common micro vesicular pores; few very fine and common coarse roots; pH H2O 4.0; clear wavy boundary to:
- Ah2(E2) 15-22 Brown (10YR 4/3) wet, brownish yellow (10YR 6/8) dry; 30% of this horizon is black mottled as a result of organic matter; sandy clay loam; weak very fine subangular blocky; slightly sticky, slightly plastic; common micro vesicular pores; common very fine to fine and few coarse roots; pH H2O 4.3; abrupt wavy boundary to:
- Bs 22-22.3 Yellowish red (10YR 5/6); hardened with iron; possible to break it by hand; continuous; material has sponge like structure; abrupt and smooth boundary to:
- Bw 22.3-45 Brownish yellow (10YR 6/8) moist; sandy loam, bouldery; structureless; non sticky, non plastic; very frequent boulders, rounded, very strongly weathered; pH H2O 5.1.

III. Brief description of the Profile

Shallow, imperfectly drained very dark grayish brown to yellowish brown profile with a dark gray, weakly developed, eluvial (?) horizon overlaid by a 30 cm thick layer of fibric to sapric soil material. Podsolization! Sandy loam with few gravel to loam containing frequent gravel. The gravel is partly very weathered causing mottling. Slightly plastic and slightly sticky. Micro to fine pores in all the horizons. Abundant roots in the organic soil material.

IV. Profile description:

- 3 cm The litter is now fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:
- 01 27-17 Composed of well identifiable litter fragments with

I Information on the site:

- a. Profile number: 29.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Placudand.
FAO: Humi-Mollic Andosol.
- d. Date of examination: 9 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios',
within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago,
Costa Rica, Central America.
- g. Elevation: 2700 m.
- h. Land form:
 - i. physiographic position of the site: on crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (17%).
- j. Land-use: montane pure oakforest of Q. Costaricensis.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.1 degrees Celcius at a depth
of 10 cm to 10.9 degrees Celsius at a depth of 40 cm. The soil
temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock.
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile wet above the iron pan,
below the pan moist.
- d. Depth of groundwater table: not detected, but after periods of
excessive rain there will be a water layer over the iron pan.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: none.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow, imperfectly drained very dark grayish brown to yellowish brown profile with a dark gray, weakly developed, eluvial (?) horizon overlaid by a 30 cm thick layer of fibric to sapric soil material. Podsolization! Sandy loam with few gravel to loam containing frequent gravel. The gravel is partly very weathered causing mottling. Slightly plastic and slightly sticky. Micro to fine pores in all the horizons. Abundant roots in the organic soil material.

IV Profile description:

- | | |
|----------|--|
| 3 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 27-17 | Composed of well identifiable litter fragments with |

- minor amounts of fine organic material. Clear wavy boundary to:
- O2 17-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Very dark grayish brown (10YR) wet; slightly sticky, slightly plastic; abundant very fine to coarse roots; pH H2O 4.9; clear wavy boundary to:
- Ah1/(E1) 0-2 Dark gray (10YR 4/1) wet, gray (10YR 5/1) dry; sandy loam; weak medium subangular blocky; slightly sticky, slightly plastic; common very fine to fine vesicular pores; few gravel (0.2-2 cm), rounded, weathered; common very fine to fine and few medium to coarse roots; pH H2O 4.6; clear wavy boundary to:
- Ah2 2-14 Very dark grayish brown (10YR 3/2) wet, light yellowish brown (10YR 6/4) dry; sandy loam, gravelly; moderate subangular blocky; slightly sticky, slightly plastic; few micro to fine vesicular pores; few gravel (0.2-5 cm), rounded, weathered and very weathered with common coarse prominent sharp brown (7.5YR) mottles; common very fine to fine and few medium to coarse roots; pH H2O 5.9; abrupt wavy boundary to:
- Bs 14-14.2 Yellowish red (5YR 5/6) moist; hardened with iron, possible to break it by hand; continuous; material has no recognizable structure; abrupt and wavy boundary to:
- Bw 14.2-53 Yellowish brown (10YR 5/4) moist; loam, in the upper part very gravelly in the lower part stony; weak subangular blocky; slightly sticky, slightly plastic, friable moist; common very fine and few fine vesicular pores; frequent gravel (0.2-4 cm), rounded, weathered with common coarse distinct clear strong brown (7.5 YR) mottles and few stones, angular, fresh; common medium to coarse roots.

III. Brief description of soil profile

Shallow imperfectly drained black to yellowish brown profile with a very weak developed iron pan. A layer of 20 cm fibric to sapric organic soil material overlies the alluvial horizon. Pedsolization! Sandy clay loam and loam over a sand loam all containing weathered to very weathered gravel and stones causing mottles. Common micro and very fine pores. Abundant roots in the sapric organic matter, few very fine to fine in the alluvial horizon.

IV. Profile description

- 4 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:
- O1 21-2 Dominantly composed of fine organic material, but

I Information on the site:

- a. Profile number: 30.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Placic Humitropept.
FAO: Humi-Dystric Regosol.
- d. Date of examination: 7 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2500 m.
- h. Land form:
 - i. physiographic position of the site: on crest (slope between 22% and 44%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: sloping (11%).
- j. Land-use: montane mixed oakforest of Q. Copeyensis and Q. Seemanni.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.7 degrees Celcius at a depth of 10 cm to 11.0 degrees Celsius at a depth of 30 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock.
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected, but after periods of excessive rains there will be some influence on the profile.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Shallow imperfectly drained black to yellowish brown profile with a very weak developed iron pan. A layer of 25 cm fibric to sapric organic soil material overlies the eluvial horizon. Podsolization! Sandy clay loam and loam over a sand loam all containing weathered to very weathered gravel and stones causing mottles. Common micro and very fine pores. Abundant roots in the sapric organic matter, few very fine to fine in the eluvial horizon.

IV Profile description:

- | | |
|---------|--|
| 4 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 21-2 | Dominantly composed of fine organic material, but |

with some litter fragments. Black (10YR) to dark reddish brown (5YR) moist; abundant very fine to coarse roots; pH H2O 4.9; abrupt wavy boundary to:

02 2-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Black (10YR 2/1) moist, dark grey (5YR 4/1) dry; sandy clay loam; moderate subangular blocky; slightly sticky, slightly plastic, friable moist; common micro to very fine vesicular pores; few very fine to fine roots; pH H2O 4.1; abrupt wavy boundary to:

Ah1/(E1) 0-3 Yellowish brown (10YR 5/4) moist, light brownish gray (10YR 6/2) dry; few medium distinct clear strong brown (7.5YR) and very pale brown (10YR) mottles; clay loam; weak subangular blocky; common micro to very fine pores; slightly sticky, slightly plastic; friable moist; few very fine to fine roots; pH H2O 4.1; abrupt wavy boundary to:

Ah2 3-10 Brown (10YR 4/3) moist, yellowish brown (10YR 5/4) dry; common coarse distinct clear strong brown (7.5YR) mottles; loam, slightly gravelly; weak medium subangular blocky; common micro to very fine pores; slightly sticky, slightly plastic, firm moist; few gravel (0.2-1 cm), rounded, weathered and strongly weathered; common medium to coarse roots; pH H2O 4.3; clear wavy boundary to:

Bs 10-10.2 Yellowish red (5YR 5/6); hardened with iron; possible to break it by hand; not continuous because this pan has been developed only in places; abrupt and wavy boundary to:

Bw 10.2-44 Yellowish brown (10YR 5/8) moist and dry (10YR 5/6); common fine to coarse faint diffuse yellowish brown (10YR) mottles; sandy loam, stony; weak subangular blocky; slightly sticky, slightly plastic, friable moist; few very fine vesicular pores; frequent gravel and stones rounded and angular, weathered and strongly weathered; few medium to coarse roots; pH H2O 4.8.

I Information on the site:

- a. Profile number: 31.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Andic Humitropept.
FAO: Humi-Andi Dystric Regosol.
- d. Date of examination: 7 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2300 m.
- h. Land form:
 - i. physiographic position of the site: straight slope of 66%.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (28%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 11.4 degrees Celcius at a depth of 10 cm to 11.3 degrees Celsius at a depth of 70 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: volcanic rock (lava).
- b. Drainage: class 3 - moderately well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected, but after periods of excessive rain groundwater influences the profile.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep, moderately well drained dark brown to yellowish brown profile with a 29 cm thick layer of fibric to sapric organic soil material. Sandy loam over loam containing some weathered gravel. Slightly sticky and slightly plastic throughout. Structure is moderate subangular blocky. Few medium pores in the upper part of the mineral soil material. Abundant roots in the organic soil material.

IV Profile description:

- | | |
|---------|--|
| 3 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 25-4 | Composed of about equal amounts of more or less fragmented litter and finely divided organic material. Dark brown (7.5 YR) moist; abrupt wavy boundary to: |

- 02 4-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5 YR) moist and dry (10YR 3/3); abundant very fine to medium and common coarse roots; abrupt wavy boundary to:
- Ah 0-15 Dark brown (10YR 3/3) moist, dark brown (7.5YR 4/2) dry; sandy loam, slightly gravelly; moderate very fine to fine subangular blocky; slightly sticky, slightly plastic, friable moist; many micro to very fine and few medium vesicular pores; common very fine to medium and few coarse roots; pH H2O 4.3; clear irregular boundary to:
- Bw1 15-58 Yellowish brown (10YR 5/8) moist, light yellowish brown (2.5Y 6/4) dry; loam, slightly gravelly in the upper part and gravelly in the lower part; moderate very fine subangular blocky; slightly sticky, slightly plastic, friable moist; common micro and few fine vesicular pores; very few gravel in the upper part and few gravel in the lower part of the profile, rounded, weathered; common very fine to fine, few medium to coarse roots; pH H2O 4.7.

General information on the soil.

- a. Parent material: colluvial, residual, weathered igneous rock
- b. Drainage: class 3 - moderately well drained
- c. Moisture conditions in the soil: profile not droughty
- d. Depth of groundwater table: not determined but since precipitation is excessive rain there will be saturated groundwaters in the profile.
- e1. Presence of surface stones: none
- e2. Presence of rock outcrops: none
- f. Evidence of erosion: not determined
- g. Presence of salt or alkali: none
- h. Human influence: none.

III Brief description of the Profile

Moderately deep and moderately well drained soil. Humid yellow profile overlaid by a 20 cm thick layer of litter and organic soil material. Clay loam over clay containing some well weathered gravel in the lower part causing surface cracking. Cracks in the higher part are a result of accumulated organic matter (10YR 5/8) of red aspect). Slightly sticky and slightly plastic. Subangular blocky. Moderate to weak subangular blocky. Common fine to medium roots in the organic soil material and coarse roots in the first two mineral horizons.

IV Profile description:

I Information on the site:

- a. Profile number: 32.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Haplic Andosol.
- d. Date of examination: 11 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 2100 m.
- h. Land form:
 - i. physiographic position of the site: on straight slope near the crest.
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (55%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 14.2 degrees Celcius at a depth of 10 cm to 14.0 degrees Celsius at a depth of 60 cm. The soil temperature regime is isomesic.

II General information on the soil:

- a. Parent material: colluvial/residual material derived from volcanic rock.
- b. Drainage: class 3 - moderately well drained.
- c. Moisture conditions in the profile: profile wet throughout.
- d. Depth of groundwater table: not detected, but after periods of excessive rain there will be influence of groundwater on the profile.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep and moderately well drained black to brownish yellow profile overlaid by a 20 cm thick layer of fibric to sapric organic soil material. Clay loam over clay containing some very weathered gravel in the lower part causing mottles. Mottles in the higher part are a result of accumulated organic matter (filled up root spaces). Slightly sticky and slightly plastic throughout. Structure is moderate to weak subangular blocky. Common micro and very fine pores. Abundant roots in the organic soil material and common very fine to fine roots in the first two mineral horizons.

IV Profile description:

- 10 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt irregular boundary to:
- O1 12-2 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark brown (7.5YR 3/2) wet; slightly sticky, slightly plastic; abundant very fine to coarse roots; pH H2O 4.5; abrupt irregular boundary to:
- O2 2-0 Black (10YR 2/1) wet; clay loam; slightly sticky, slightly plastic; common micro to very fine vesicular pores; common very fine to fine roots; pH H2O 4.1; abrupt irregular boundary to:
- Ah1 0-1 Dark brown (10YR 4/3) wet, yellowish brown (10YR 5/6) dry; clay; slightly sticky, slightly plastic; moderate subangular blocky; common micro to very fine vesicular pores; common very fine to fine roots; pH H2O 4.3; abrupt irregular boundary to:
- Ah2 1-23 Yellowish brown (10YR 5/8) wet; few, fine, faint, clear, brownish yellow (10YR) mottles and common coarse, prominent sharp black to dark brown mottles; clay; slightly sticky, slightly plastic; moderate subangular blocky; common micro to very fine vesicular pores; few fine to coarse roots; pH H2O 4.6; gradual wavy boundary to:
- Bw 23-55 Brownish yellow (10YR 6/6) wet, very pale brown (10YR 8/4) dry; common fine, faint, clear brownish yellow (10YR) mottles; clay, slightly gravelly; slightly sticky, slightly plastic; weak subangular blocky; common micro to very fine vesicular pores; few gravel, rounded, weathered and strongly weathered; few fine to coarse roots; pH H2O 5.0.

Moderately deep imperfectly drained very dark grayish brown (aluvial horizon?) to yellowish brown profile overlaid by a 32 cm thick layer of fibric to sapric organic soil material. Structural development is moderate crumb to weak crumb. Micro and very fine pores throughout and root distribution is normal except for the fact that one finds abundant roots in the organic soil material.

IV Profile description:

- 15 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration.
- O1 20-2 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark

I Information on the site:

- a. Profile number: 33.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Acric Hapludand.
FAO: Humi-Umbric Andosol.
- d. Date of examination: 12 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1900 m.
- h. Land form:
 - i. physiographic position of the site: on small crest (slope of 77%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (44%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 16 degrees Celcius at a depth of 10 cm to 15 degrees Celsius at a depth of 80 cm. The soil temperature regime is isothermic.

II General information on the soil:

- a. Parent material: volcanic rock (lava).
- b. Drainage: class 2 - imperfectly drained.
- c. Moisture conditions in the profile: profile wet throughout (after four days of heavy rain).
- d. Depth of groundwater table: water stands at a depth of some 50 cm in the soil pit.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep imperfectly drained very dark grayish brown (eluvial horizon(?)) to yellowish brown profile, overlaid by a 32 cm thick layer of fibric to sapric organic soil material. Structural development is moderate crumb to weak crumb. Micro and very fine pores throughout and root distribution is normal except for the fact that one finds abundant roots in the organic soil material.

IV Profile description:

- | | |
|---------|--|
| 15 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. |
| 01 20-2 | Dominantly composed of fine organic material, free of litter fragments, but mineral grains are present. Dark |

- Information: brown (7.5YR) wet, very dark grayish brown (10YR 3/2) dry; abundant very fine to coarse roots; pH H2O 4.0); abrupt wavy boundary to:
- 02 2-0 Very dark grayish brown (10YR 3/2) wet, very dark brown (10YR 2/2) dry; sandy loam; moderate fine crumb; slightly sticky, slightly plastic; many very fine and common fine vesicular pores; common fine to coarse roots; pH H2O 3.9; clear wavy boundary to:
- Ah 0-22 Dark brown (10YR 4/3) wet, dark yellowish brown (10YR 4/4) dry; sandy clay loam, slightly gravelly; moderate fine crumb; many very fine, common fine vesicular pores; very few gravel (0.2-4 cm), rounded, weathered and very weathered; common fine to coarse roots; pH H2O 4.5; gradual wavy boundary to:
- Bw 22-60 Yellowish brown (10YR 5/6) wet, yellowish brown (10YR 5/6) dry; few fine, faint, clear, strong brown (7.5YR) mottles; sandy clay loam, slightly gravelly; moderate fine crumb; slightly sticky, slightly plastic; many very fine and common fine vesicular pores; very few gravel (0.2-4 cm), rounded, weathered and very weathered; few fine to medium roots; pH H2O 5.1.

IV. Profile description:

- 5 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to:
- 01 3-0 Dominantly composed of fine organic material, free of litter fragments, but mineral grains are

I Information on the site:

- a. Profile number: 34.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Hapludand.
FAO: Humi-Umbic Andosol.
- d. Date of examination: 13 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1700 m.
- h. Land form:
 - i. physiographic position of the site: on crest (slope 47%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: moderately steep (22%).
- j. Land-use: submontane lauraceous forest with dwarf palms.
- k. Climate: see section 2.2 of this report.
The soil temperature was almost univorm (18 degrees Celcius) throughout the entire soil depth. The soil temperature regime is isothermic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock (lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately well drained very dark grayish brown to brownish yellow profile with a layer of 8 cm fibric and sapric organic soil material. Structural development is moderate crumb and also subangular blocky in the Ah horizon. Sandy loam over a sandy clay loam containing some strongly weathered gravel causing mottling. Common micro and very fine pores. Root distribution is normal but one finds abundant roots in the lower part of the organic soil material.

IV Profile description:

- | | | |
|----|------|--|
| | 5 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt wavy boundary to: |
| 01 | 3-0 | Dominantly composed of fine organic material, free of litter fragments, but mineral grains are |

present. Dark brown (7.5YR) moist; slightly sticky, slightly plastic; abundant very fine to coarse roots; pH H2O 4.8; gradual wavy boundary to:

Ah1 0-20 Very dark grayish brown (10YR 3/2) moist and dry (10YR 4/2); sandy loam; moderate fine crumb and very fine subangular blocky; slightly sticky, slightly plastic, friable moist; many micro to very fine and common fine vesicular pores; very few gravel (0.2-3 cm), rounded, strongly weathered with few, medium, distinct, sharp, strong brown (7.5YR) mottles; common very fine to coarse roots; pH H2O 4.5; gradual wavy boundary to:

Ah2/Bw1 20-27 Dark yellowish brown (10YR 4/4) moist, yellowish brown (10YR 5/4); sandy loam, slightly gravelly; moderate very fine and very fine crumb; slightly sticky, slightly plastic, friable moist; common micro to very fine vesicular pores; few gravel, angular and rounded, weathered and strongly weathered with few medium, faint, sharp, strong brown (7.5YR) mottles; few very fine to fine and common medium to coarse roots; pH H2O 4.9; clear wavy boundary to:

Bw 27-77 Brownish yellow (10YR 6/6) moist, pale yellow (2.5Y 7/4) dry; sandy clay loam, slightly gravelly; moderate fine crumb; sticky, plastic, friable moist; common micro to very fine vesicular pores; very few gravel, angular and rounded, weathered and strongly weathered with common medium to coarse, faint diffuse brownish yellow (10YR) mottles; few very fine to coarse roots, pH H2O 5.0.

I Information on the site:

- a. Profile number: 35.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Humitropept.
FAO: Humi-Mollic Regosol.
- d. Date of examination: 13 march 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on left side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1500 m.
- h. Land form:
 - i. physiographic position of the site: on small crest (slope of 66%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: steep (33%).
- j. Land-use: submontane lauraceous forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 18.7 degrees Celcius at a depth of 10 cm to 18.9 degrees Celsius at a depth of 50 cm. The soil temperature regime is isothermic

II General information on the soil:

- a. Parent material: volcanic rock (lava).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: none.
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: not detected.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep well drained dark yellowish brown to brownish yellow profile with a 12 cm thick layer of fibric to sapric organic soil material. Loamy sand containing some very weathered gravel causing mottles. Frequent gravel and stones in the lower part of the horizon. Moderate crumb structure. Slightly sticky and slightly plastic throughout. Micro to medium pores in the mineral part of the horizon. Root development is normal.

IV Profile description:

- | | |
|--------|---|
| 5 cm | The litter is non fragmented, but slightly altered, -evidenced by its partial or complete discolorisation. Abrupt wavy boundary to: |
| 01 7-0 | Dominantly composed of fine organic material, almost free of litter fragments, but mineral grains are |

- present. Dark brown (7.5YR) moist; many micro to medium vesicular pores; abundant very fine to coarse roots; pH H₂O 4.9; abrupt wavy boundary to:
- Ah 0-23 Dark yellowish brown (10YR 3/4) moist, very pale brown (10YR 7/4) dry; loamy sand, slightly gravelly; moderately very fine crumb; slightly sticky, slightly plastic, very friable moist; many micro to very fine and few medium vesicular pores; very few gravel (0.2-2 cm), rounded, strongly weathered; many very fine to coarse roots; pH H₂O 4.8; clear irregular boundary to:
- Bw1 23-43 Yellowish brown (10YR 5/6) moist, very pale brown (10YR 8/4) dry; loamy sand, slightly gravelly; moderate very fine crumb; slightly sticky, slightly plastic, friable moist; many micro to very fine and common fine to medium vesicular pores; few gravel, rounded, strongly weathered with few medium to coarse, distinct, sharp very pale brown (10YR) mottles; common fine to coarse roots; pH H₂O 4.9; clear irregular boundary to:
- Bw2 43-63 Brownish yellow (10YR 5/8) moist, yellow (10YR 7/6) dry; loamy sand, gravelly and slightly stony; moderate very fine crumb and very fine subangular blocky; slightly sticky, slightly plastic, friable moist; many micro to fine and common medium vesicular pores; frequent gravel and stones, angular and rounded, weathered and strongly weathered with few medium to coarse, distinct, sharp very pale brown (10YR) mottles; few medium to coarse roots; pH H₂O 5.2.

- a. Parent material: colluvium derived from weathered granite overlies sedimentary rocks and is silty with some cement.
- b. Drainage class: well drained
- c. Moisture conditions in the profile: profile moist
- d. Depth of groundwater table: not detected
- e. Presence of surface water: extending to 100 m and boundaries
- f. Presence of rock outcrops: none
- g. Evidence of erosion: signs of land slides
- h. Presence of salt or alkali: none
- i. Human influence: none

III. Brief description of the profile:

Moderately deep well drained profile with a 22 cm thick layer of fibric and sapric organic soil material. Loamy sand to sandy loam containing gravel, stones and boulders. Structural development is weak. Micro to fine pores and normal root distribution. Abundant roots in the organic soil material and common roots in the mineral soil material.

IV. Profile description:

- 5 cm The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt irregular boundary to:
- O2 17-8 Dominantly composed of fine organic material, almost free of litter fragments but mineral grains are

I Information on the site:

- a. Profile number: 36.
- b. Soil Name: -
- c. Higher Category Classification;
USDA: (Histic) Typic Humitropept.
FAO: Humi-Mollic Regosol.
- d. Date of examination: 14 March 1989.
- e. Author: J.G. van Uffelen.
- f. Location: just on right side of the 'Camino de los Indios', within the 'Parque Nacional Chirripó'.
East of the town of San Isidro, within the province of Cartago, Costa Rica, Central America.
- g. Elevation: 1300 m.
- h. Land form:
 - i. physiographic position of the site: straight slope (88%).
 - ii. topography of surrounding country: steeply dissected.
 - iii. microtopography: none.
- i. Slope on which profile is sited: very steep (88%).
- j. Land-use: submontane lauraceous forest.
- k. Climate: see section 2.2 of this report.
The soil temperature ranged from 20.3 degrees Celcius at a depth of 10 cm to 17.4 degrees Celsius at a depth of 30 cm. The soil temperature regime is isothermic.

II General information on the soil:

- a. Parent material: colluvial material derived from volcanic rock which overlies sedimentary rock (very fine siltstone with calcareous cement).
- b. Drainage: class 4 - well drained.
- c. Moisture conditions in the profile: profile moist throughout.
- d. Depth of groundwater table: not detected.
- e1. Presence of surface stones: exceedingly stony (gravel, rocks and boulders).
- e2. Presence of rock outcrops: none.
- f. Evidence of erosion: risk of land slides.
- g. Presence of salt or alkali: none.
- h. Human influence: none.

III Brief description of the Profile:

Moderately deep well drained profile with a 22 cm thick layer of fibric and sapric organic soil material. Loamy sand to sandy loam containing gravel, stones and boulders. Structural development is weak. Micro to fine pores and normal root distribution. Abundant roots in the organic soil material and common roots in the mineral soil material.

IV Profile description:

- | | |
|---------|---|
| 5 cm | The litter is non fragmented, but slightly altered, evidenced by its partial or complete discoloration. Abrupt irregular boundary to: |
| 02 17-0 | Dominantly composed of fine organic material, almost free of litter fragments, but mineral grains are |

Ah/Bw 0-63

present. Dark brown (7.5YR) moist, dark grayish brown (10YR 4/2) dry; abundant very fine to medium roots; pH H₂O 5.2; clear irregular boundary to:

Dark brown (10YR 3/3) moist; spots of loamy sand and sandy loam, gravelly, stony and boulderly; weak very fine crumb to structureless; slightly sticky, slightly plastic, friable moist; few fine, many micro to very fine vesicular pores; few gravel, stones and boulders, angular and rounded, weathered and strongly weathered with common coarse distinct clear brownish yellow (10YR) mottles; common very fine to coarse roots; pH H₂O 5.7.

Appendix 10 Chemical and physical analyses of the soil profiles

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
15-15	H1	75	13	10	42.9
15-7	H2	78	12	10	27.9
7-0	H3	69	19	12	19.8

pH H2O	pH-KCl	pH-NaF	Phos. ret. (%)
5.2	4.1	4.3	57
5.3	4.0	4.5	78
5.3	4.1	4.5	86

CDC	Ca	Mg	K	Na	MS	Extrac. Acid.
--- cmol(+).kg-1 ---						
39.4	1.27	0.8	0.3	0.12	2	1.5
63.3	0.6	0.5	0.3	0.12	2	2.7
19.8	0.57	0.3	0.3	0.12	2	0.8

Al	Ca	Mg	K	F	Na	Mn	Cu	Pb
--- cmol(+).dm3 ---			--- µg/dm3 ---					
1.20	1.5	0.5	0.3	18	1.5	2	1	>100
4.50	1.5	0.6	0.3	22	1.5	1	1	76
1.40	1.5	0.3	0.3	16	1.5	1	1	16

Depth (cm)	Dry bulk dens. (g/cm3)
15-15	0.28
15-7	0.29

--- Chemical and physical analyses - profile 1 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
25-15	H1	75	13	12	42.9
15-7	H2	78	12	10	27.9
7-0	H3	69	19	12	19.8

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
5.2	4.1	8.5	57
5.3	4.0	8.5	78
5.5	4.1	9.5	86

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
59.4	1.2	0.8	0.8	0.17	5	1.5
63.2	0.6	0.5	0.6	0.15	3	3.7
55.0	0.5	0.3	0.3	0.12	2	5.9

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
1.50	1.5	0.5	0.3	12	3.8	1	1	+100
4.00	1.5	0.6	0.2	21	3.2	1	1	76
3.40	1.5	0.3	0.1	16	3.0	1	1	30

Depth (cm)	Dry bulk dens. (g/cm ³)
25-15	0.29
15-7	0.29

--- Chemical and physical analyses - profile 2 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
0-13	O/Ah	73	15	12	28.9
13-50	Ah	73	21	6	2.1
50-75	Bw	59	27	14	1.6

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
5.2	4.3	10.0	90
6.1	4.7	10.2	92
6.0	4.3	9.7	68

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
55.5	0.5	0.3	0.4	0.11	2	3.8
19.3	0.8	0.2	0.2	0.09	6	0.5
14.3	0.7	0.2	0.3	0.12	9	0.8

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
2.00	1.5	0.4	0.2	13	3.8	2	1	+100
0.10	1.5	0.3	0.1	8	2.6	1	1	27
0.90	1.5	0.3	0.1	12	3.6	2	4	18

Depth (cm)	Dry bulk dens. (g/cm3)
0-13	0.45

--- Chemical and physical analyses - profile 3 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
1-0	O1	-	-	-	-
0-7	Ah	55	35	10	16.6
7-28	Bw1	73	21	6	3.5
28-100	Bw2	69	23	8	1.6

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
6.2	4.5	9.8	89
6.5	5.4	10.2	100
6.4	5.0	9.7	52

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
44.5	4.7	0.4	0.3	0.12	12	1.0
20.4	0.8	0.2	0.2	0.12	7	0.1
16.5	0.6	0.2	0.2	0.11	7	0.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
-	-	-	-	-	-	-	-	-
0.30	2.5	0.4	0.1	9	3.0	1	1	+100
0.10	1.5	0.3	0.1	6	3.4	1	1	50
0.10	1.5	0.6	0.1	8	2.2	1	1	8

Depth (cm)	Dry bulk dens. (g/cm3)
0-7	0.54
7-28	0.77

--- Chemical and physical analyses - profile 4 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
0-9	Ah	57	27	15	17.9
9-20	Ah/(E)	71	21	8	11.0
20-21	Bs	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
5.9	4.2	10.0	89
6.3	4.5	11.5	98
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
29.1	1.2	0.3	0.3	0.10	7	4.0
28.1	0.6	0.2	0.3	0.10	4	1.3

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
-	-	-	-	-	-	-	-	-
2.30	1.5	0.8	0.2	20	1.0	1	1	+100
0.70	1.5	0.6	0.1	10	1.4	1	2	70

Depth (cm)	Dry bulk dens (g/cm3)
3-11	0.77
11-35	0.83
35-60	0.92

--- Chemical and physical analyses - profile 5 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
5-0	O1	-	-	-	-
0-3	Ah1	55	35	10	17.1
3-11	Ah2	47	37	16	7.8
11-35	Bw1	55	29	16	7.5
35-60	Bw2	45	41	14	5.9
60-70	C	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
6.4	5.2	9.4	65
6.4	4.5	9.7	82
6.3	4.5	10.0	94
6.2	4.4	10.2	93
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
48.4	26.2	4.2	0.9	0.16	65	0.2
31.9	10.0	2.0	0.3	0.15	39	0.6
28.1	3.1	0.6	0.2	0.10	15	1.1
34.6	2.1	0.4	0.2	0.09	8	1.5
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
0.10	16.5	3.0	0.3	10	4.6	44	1	58
1.00	7.0	2.0	0.2	12	3.4	21	2	73
0.80	4.0	1.1	0.1	7	2.6	6	1	40
1.50	2.5	0.9	0.1	6	3.8	5	1	+100
-	-	-	-	-	-	-	-	-

Depth (cm)	Dry bulk dens. (g/cm3)
3-11	0.77
11-35	0.88
35-60	0.92

--- Chemical and physical analyses - profile 6 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
3-0	O	59	29	12	48.2
0-22	Ah	57	31	12	6.7
22-57	Bw1	59	29	12	8.0
57-67	Bw2	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
6.3	5.0	9.0	44
6.5	4.7	9.9	96
6.3	5.0	8.8	26
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
72.0	48.8	5.0	1.6	0.09	77	0.1
41.2	15.0	1.6	0.9	0.10	43	0.3
83.0	50.0	4.8	1.8	0.10	68	0.5
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
0.10	19.0	2.2	0.4	15	7.4	60	1	30
0.15	11.5	1.9	0.4	20	4.0	16	2	35
0.10	13.0	1.6	0.4	21	5.8	84	1	12
-	-	-	-	-	-	-	-	-

--- Chemical and physical analyses - profile 7 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
3-0	O	-	-	-	-
0-15	Ah1	59	33	8	11.5
15-40	Ah2	61	31	8	4.3
40-60	Bw	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
6.3	4.8	10.9	99
6.4	5.1	10.2	100
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
42.9	3.4	0.5	0.4	0.08	10	0.5
28.1	1.5	0.4	0.3	0.08	8	0.2
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
0.15	3.0	1.0	0.2	21	3.4	10	2	85
0.10	2.0	1.0	0.3	12	3.4	14	1	55
-	-	-	-	-	-	-	-	-

--- Chemical and physical analyses - profile 8 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
3-0	01	-	-	-	-
0-10	Ah1/02	61	29	10	24.9
10-45	Ah2	67	23	10	8.0
45-60	Bw	65	23	12	1.6

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
6.5	5.3	9.2	36
6.3	4.4	9.7	84
6.2	3.9	9.4	54

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
57.8	42.5	3.5	1.7	0.09	83	0.2
27.5	15.6	1.2	0.7	0.11	64	1.8
30.2	20.0	2.9	0.3	0.14	77	4.8

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
0.10	14.0	1.7	0.5	20	4.2	260	1	20
1.00	9.0	1.6	0.3	24	1.4	73	2	80
5.00	14.5	3.5	0.2	17	1.0	43	2	63

Depth (cm)	Min. (%)	Org. (%)
7-0	12.9	87.1
0-2	64.6	35.4
2-8/14	71.4	28.6

--- Chemical and physical analyses - profile 9 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
7-0	O2	-	-	-	61.1
0-2	E(Ah)	49	31	20	18.0
2-8/14	Bw	47	31	22	17.2
8/14-38	2Bw1	73	17	10	11.8
38-43	2Bw2	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	4.2	7.9	-
4.2	3.7	7.8	38
4.4	4.0	8.2	79
4.8	4.6	10.8	98
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
57.75	3.25	1.88	-	-	-	-
49.50	1.25	0.94	0.96	0.12	7	3.9
52.25	1.13	0.73	0.64	0.14	5	10.3
48.25	0.63	0.29	0.32	0.08	3	2.1
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----			--- ug/ml-----			-----		
-	3.5	1.3	0.89	29	5.4	44	1	+100
6.00	1.0	0.9	0.41	22	2.4	16	1	+100
11.00	1.5	1.1	0.29	24	3.0	13	2	+100
2.60	1.5	0.8	0.16	5	2.0	3	2	+100
-	-	-	-	-	-	-	-	-

Depth (cm)	Min. (%)	Org. (%)
7-0	12.9	87.1
0-2	64.6	35.4
2-8/14	71.4	28.6

--- Chemical and physical analyses - profile 10 -----

Depth (cm)	Soil	Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
7-0	O2	-	-	-	40.7
0-1/28	Ah	55	35	10	7.0
1/28-53	Bw	49	37	14	5.4

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	4.8	8.3	-
5.0	4.8	10.7	98
5.1	4.5	9.6	90

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
35.20	1.38	0.66	0.19	0.10	7	0.4
35.70	1.38	0.70	0.22	0.09	7	0.6

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
-	7.5	2.6	0.62	39	5.4	400	2	+100
0.40	3.0	0.9	0.12	10	1.4	12	4	67
0.70	3.0	1.0	0.12	6	1.6	17	4	63

Depth (cm)	Min. (%)	Org. (%)
7-0	15.9	84.1

--- Chemical and physical analyses - profile 11 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
10-5	02	-	-	-	-
5-0	03	-	-	-	44.0
0-2/7	Ah/(E)	53	29	18	12.1
2/7-20	Ah/B	55	27	18	13.4
20-28/38	Bw1	55	23	12	7.2
28/38-50/57	Bw2	65	27	8	7.8
50/57-110	C	65	27	8	1.9

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
4.3	5.2	9.2	70
4.0	4.4	8.4	41
4.8	4.0	11.0	90
4.9	4.6	11.3	97
5.2	4.7	10.5	61

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
55.55	3.31	1.63	0.87	-	-	-
31.90	0.69	0.23	0.19	0.10	4	2.0
36.30	0.63	0.39	0.32	0.09	4	3.4
20.35	0.56	0.23	0.16	0.12	5	1.0
33.55	0.69	0.24	0.16	0.12	4	0.7
13.75	1.30	0.41	0.29	0.11	15	0.4

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----				
-	-	-	-	-	-	-	-	-
-	5.0	3.1	0.49	26	13.0	20	3	+100
4.40	1.5	0.7	0.19	22	3.0	1	3	+100
5.00	1.5	0.7	0.21	25	3.4	1	3	+100
2.50	1.5	0.6	0.15	10	1.6	1	1	+100
1.50	1.5	0.6	0.15	5	1.8	3	2	47
0.80	1.5	0.5	0.24	3	1.8	1	1	52

Depth (cm)	Min. (%)	Org. (%)
10-5	20.4	79.6
5-0	13.5	86.5

--- Chemical and physical analyses - profile 12 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
22-12	O2	-	-	-	65.4
12-0	O3	-	-	-	-
0-2	Ah/(E)	79	7	14	15.4
2-6/14	Ah/B	75	18	12	19.3
6/14-43	Bw1	83	9	8	14.5
43-48	Bw2	73	17	10	4.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
4.1	3.9	8.1	27
4.2	4.3	9.2	91
5.1	4.8	11.2	98
5.4	5.2	11.1	98

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
82.50	2.63	1.00	-	-	-	-
115.50	1.44	1.13	-	-	-	-
32.45	0.75	0.31	0.32	0.22	5	2.5
66.00	0.63	0.34	0.42	0.14	2	2.0
60.50	0.63	0.29	0.19	0.16	2	0.4
22.00	0.63	0.19	0.13	0.13	5	0.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----			--- ug/ml-----					
0-30	3.0	1.1	0.58	43	7.4	14	4	85
-	3.0	0.8	0.44	46	7.0	4	1	+100
2.50	2.5	0.5	0.23	36	4.2	1	1	+100
4.40	2.0	0.6	0.19	10	3.6	1	1	+100
0.50	2.5	0.6	0.15	3	2.6	1	1	+100
0.10	2.5	0.6	0.15	3	2.0	1	2	+100

Depth (cm)	Min. (%)	Org. (%)
22-12	2.7	97.3
12-0	4.9	95.1
0-2	69.7	30.3
2-6/14	60.5	39.5

--- Chemical and physical analyses - profile 13 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
9-5	01	-	-	-	-
5-1	02	-	-	-	56.9
1-0	O/E	-	-	-	59.0
0-6	Ah/B	45	37	18	14.7
6-34	Bw1	63	19	18	8.6
34-54	Bw2	63	19	18	1.3

pH(H ₂ O)	pH(KCl)	pH(NaF)	Phos. ret. (%)
5.2	4.8	8.2	-
-	-	-	-
-	-	-	-
4.3	4.4	8.6	73
4.8	4.8	10.7	94
4.9	4.7	10.2	87

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg ⁻¹ -----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
41.25	0.50	0.33	0.29	0.15	3	3.0
41.80	0.38	0.28	0.16	0.12	2	1.5
16.50	0.81	0.25	0.19	0.10	8	4.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm ³ -----				--- ug/ml -----				
0.50	7.5	2.3	0.66	20	10.0	98	1	+100
-	4.0	2.6	1.31	25	10.6	30	1	+100
-	-	-	-	-	-	-	-	-
4.00	2.0	0.8	0.21	25	5.6	1	1	+100
2.00	1.5	0.4	0.12	8	3.2	1	2	+100
3.80	1.5	1.2	0.10	10	4.0	2	3	+100

Depth (cm)	Min. (%)	Org. (%)
9-5	33.0	67.0
5-1	13.3	86.7
0-6	72.1	27.9

--- Chemical and physical analyses - profile 14 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
8-4	01	-	-	-	-
4-0	02	-	-	-	-
0-4	Ah1	61	23	16	20.4
4-17/35	Ah2	83	19	8	16.3
17/35-48	Bw1	51	31	18	4.6

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	4.3	-	-
4.2	4.1	8.4	59
4.7	4.7	11.0	95
5.0	5.0	10.8	97

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
34.10	0.94	0.75	0.51	0.17	7	2.3
51.70	0.50	0.28	0.32	0.12	2	1.6
19.25	0.44	0.21	0.22	0.10	5	0.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	6.5	2.8	0.62	39	6.6	51	1	40
4.00	3.0	1.5	0.31	33	3.0	2	1	+100
2.00	2.0	1.2	0.18	3	1.4	1	2	+100
0.50	2.0	1.0	0.13	3	2.0	1	2	+100

Depth (cm)	Min. (%)	Org. (%)
4-0	7.0	93.0
0-4	60.0	40.0

--- Chemical and physical analyses - profile 15 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
4-0	O1	-	-	-	-
0-5	O/Ah1	55	29	16	20.6
5-11	Ah2	55	29	16	12.3
11-36	Bw1	33	31	36	7.2
36-46	Bw2	57	21	22	1.1

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
4.0	4.4	8.1	69
4.3	4.5	8.6	82
4.8	4.7	8.7	62
4.5	4.8	9.8	88

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
49.50	1.06	0.80	0.74	0.15	6	2.6
17.50	0.94	0.50	0.45	0.16	12	3.0
39.60	0.69	0.25	0.29	0.12	3	1.3
27.50	0.63	0.29	0.42	0.11	5	1.3

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
4.50	2.0	1.3	0.34	16	4.2	7	2	+100
5.00	2.0	1.3	0.24	12	4.0	2	2	+100
3.00	2.0	0.9	0.19	7	2.2	1	6	+100
2.50	2.0	1.0	0.26	6	2.0	2	2	+100

Depth (cm)	Min. (%)	Org. (%)
4-0	48.1	51.9

--- Chemical and physical analyses - profile 16 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
2-0	O1	-	-	-	-
0-28	Ah	41	33	26	7.0
28-38	Bw1	29	27	44	2.4

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
4.8	5.1	9.4	83
5.1	5.5	8.8	79

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
40.70	1.40	0.50	0.39	0.10	6	0.8
15.70	1.20	0.21	0.20	0.09	11	1.0

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
-	-	-	-	-	-	-	-	-
2.00	3.0	1.0	0.31	9	2.0	13	3	+100
1.00	2.0	1.0	0.19	6	1.6	2	3	+100

Depth (cm)	Min. (1)	Org. (1)
12-8	2.9	96.1
8-0	4.0	96.0

--- Chemical and physical analyses - profile 17 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
12-8	01	-	-	-	-
8-0	02	-	-	-	-
0-2	Ah1/(E)45		47	8	18.8
2-20	Ah2	57	31	12	11.8
20-33	Bw	49	41	10	3.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
4.2	3.9	8.0	40
4.8	4.5	10.9	97
5.1	4.7	10.6	93

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
40.15	0.81	0.58	0.61	0.12	5	3.8
25.85	0.69	0.26	0.29	0.24	6	1.2
48.40	0.63	0.45	0.22	0.19	3	0.6

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
4.00	1.0	0.7	0.27	22	3.2	2	1	+100
5.00	1.5	1.0	0.15	6	1.6	1	1	+100
2.00	1.5	0.6	0.13	5	3.4	1	1	41

Depth (cm)	Min. (%)	Org. (%)
12-8	3.9	96.1
8-0	4.0	96.0

--- Chemical and physical analyses - profile 18 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
18-10	01	-	-	-	-
10-08	02	-	-	-	-
0-3	O/Ah1	59	29	12	22.5
3-8	Ah2	35	51	14	11.5
8-62	Bw	39	45	16	3.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
4.2	3.8	7.8	40
4.6	4.3	9.4	85
5.0	4.6	10.5	83

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) .kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
20.90	0.81	0.45	0.67	0.14	10	2.6
18.70	1.25	0.51	0.26	0.12	11	2.3
61.60	0.63	0.23	0.26	0.19	2	0.6

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) .dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
6.00	1.0	0.7	0.25	25	4.8	2	1	+100
5.00	1.5	0.7	0.16	17	2.8	1	1	+100
2.00	1.5	0.9	0.12	6	2.0	2	1	37

Depth (cm)	Min. (%)	Org. (%)
18-10	4.1	95.9
10-0	-	-
0-3	61.2	38.8

--- Chemical and physical analyses - profile 19 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
15-9	01	-	-	-	-
9-0	02	-	-	-	-
0-2	O/Ah1	57	25	18	-
2-8	Ah2	51	31	18	18.0
8-43	Ah3/Bw	71	21	8	10.2

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
4.4	3.8	-	-
4.5	4.2	9.8	94
5.0	4.7	10.9	99

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
62.70	0.50	0.45	0.77	-	-	-
51.70	0.56	0.35	0.39	0.11	3	2.6
33.55	0.56	0.23	0.19	0.10	3	0.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----				
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
4.00	1.5	1.0	0.29	29	4.0	3	1	+100
4.80	1.0	0.9	0.24	11	3.4	2	1	+100
0.70	1.0	0.7	0.09	10	0.6	1	1	73

Depth (cm)	Min. (%)	Org. (%)	Dry bulk density (g/cm ³)
15-9	3.5	96.5	
9-0	-	-	
0-2	52.5	47.5	1.27
2-8	67.6	32.4	
8-12	70.0	30.0	

--- Chemical and physical analyses - profile 20 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
18-15	01	-	-	-	-
15-10	02	-	-	-	-
10-0	03	-	-	-	-
0-6	Ah1/(E)43		39	18	15.8
6-12	Ah2	49	37	14	15.3
12-32	Ah3	73	17	10	11.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	-	-	-
-	3.9	7.9	-
4.1	3.5	7.7	32
4.5	4.1	9.3	92
5.0	4.5	10.7	98

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
64.35	3.13	1.88	-	-	-	-
41.80	0.63	0.35	0.32	0.15	3	1.9
50.05	0.88	0.34	0.29	0.21	3	2.4
41.25	0.81	0.31	0.22	0.12	4	1.1

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	2.0	1.4	0.70	22	5.4	46	1	+100
3.50	1.0	0.8	0.16	25	3.0	1	4	+100
5.50	1.0	0.7	0.13	11	2.0	2	2	+100
1.80	1.5	0.6	0.07	7	1.2	1	2	+100

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
18-15	5.0	95.0	
15-10	-	-	
10-0	13.1	86.9	0.37
0-6	75.8	24.2	
6-12	70.0	30.0	

--- Chemical and physical analyses - profile 21 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
5-0	O	-	-	-	-
0-18	Ah	64	18	18	16.3
18-45	Ah/Bw1	42	48	10	4.8
45-60	Bw2	44	40	16	1.4
60-75	Bw3	66	22	12	1.1

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
5.0	4.2	9.2	89
4.7	4.5	10.3	95
4.9	4.4	9.6	76
4.9	4.4	9.8	82

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
45.65	1.94	0.68	0.61	0.10	7	1.7
28.85	1.13	0.40	0.26	0.08	6	2.0
11.00	1.00	0.44	0.19	0.12	16	2.0
20.35	1.06	0.41	0.22	0.11	9	1.0

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----				
-	-	-	-	-	-	-	-	-
4.50	1.0	1.0	0.32	16	4.6	5	1	+100
1.50	1.0	0.8	0.09	7	1.2	2	1	+100
3.60	1.0	0.8	0.09	15	2.0	2	1	+100
6.30	1.0	0.8	0.13	15	1.6	3	1	35

Depth (cm)	Min. (%)	Org. (%)
5-0	47.1	52.9

--- Chemical and physical analyses - profile 22 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
10-0	O	-	-	-	42.9
0-5	Ah	56	34	10	15.5
5-40	Ah/Bw1	36	54	10	8.6
40-55	Bw2	36	36	28	3.2

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.8	4.2	7.9	-
4.8	4.3	9.4	91
5.0	4.7	10.3	98
4.9	4.4	9.4	91

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
40.70	1.00	0.43	0.55	0.12	5	1.9
32.45	1.25	0.45	0.30	0.11	6	1.3
17.05	1.13	0.45	0.29	0.34	13	1.6

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----				
0.70	2.5	1.4	0.95	33	2.4	13	1	+100
3.00	1.0	0.8	0.29	11	1.2	9	1	+100
0.60	0.0	0.6	0.15	3	1.0	2	1	+100
0.80	0.0	0.6	0.15	6	0.6	2	1	+100

Depth (cm)	Min. (%)	Org. (%)
10-0	24.1	75.9

--- Chemical and physical analyses - profile 23 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
15-0	O	-	-	-	-
0-8	Ah1/(E)	52	30	18	15.8
8-28	Ah2/(E2)	58	30	18	15.8
28-34	Ah3	52	34	14	11.5
34-35	Bs	-	-	-	-
35-50	C	52	38	10	2.1

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
4.1	3.7	7.8	41
4.7	4.2	10.5	96
4.8	4.4	10.7	96
-	-	-	-
5.2	4.6	10.6	90

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
37.95	1.06	0.46	0.48	0.34	6	3.5
51.15	1.00	0.41	0.26	0.10	3	3.0
31.90	1.00	0.41	0.22	0.12	5	1.8
-	-	-	-	-	-	-
22.00	0.75	0.36	0.16	0.13	6	1.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----				
-	0.0	0.8	0.23	35	1.6	8	1	+100
6.70	0.0	0.8	0.23	35	1.6	8	1	+100
4.60	0.0	0.7	0.10	12	1.0	2	1	+100
3.40	0.0	0.7	0.10	8	0.6	1	1	+100
-	-	-	-	-	-	-	-	-
0.80	0.0	0.6	0.06	7	0.8	1	1	+100

Depth (cm)	Min. (%)	Org. (%)
0-8	74.4	25.6

--- Chemical and physical analyses - profile 24 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
38-0	0	-	-	-	60.0
0-3	Ah1	59	23	18	19.8
3-14	Ah2	53	25	22	9.4

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	4.6	8.0	-
4.5	3.8	9.6	83
4.7	4.0	8.7	83

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) .kg-1-----						
94.60	0.88	0.80	1.22	-	-	-
57.75	0.88	0.29	0.26	-	-	2.5
37.40	0.75	0.23	0.16	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) .dm3-----				--- ug/ml-----				
-	0.0	1.0	0.35	26	9.4	6	1	+100
5.50	0.0	0.8	0.16	39	2.0	1	1	82
1.70	0.0	0.6	0.15	25	0.6	1	1	67

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
38-0	14.7	85.3	
0-3	67.1	32.9	0.99

--- Chemical and physical analyses - profile 25 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
0-22	O/Ah	-	-	-	19.4
22-34	Ah/(E)	55	25	20	9.9
34-35	Bs	-	-	-	-
35-45	BC	-	-	-	1.3

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.6	4.2	9.5	80
5.1	4.4	10.8	89
-	-	-	-
5.5	4.6	9.2	43

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
52.25	0.81	0.29	0.32	-	-	4.0
25.85	0.50	0.10	0.13	-	-	0.5
-	-	-	-	-	-	-
11.00	0.56	0.11	0.10	-	-	0.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
4.00	0.0	0.7	0.19	11	0.6	1	1	+100
2.00	0.5	0.7	0.19	10	1.0	1	1	+100
-	-	-	-	-	-	-	-	-
0.50	1.0	0.7	0.16	11	1.2	2	1	40

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
0-22	56.7	43.3	1.09
22-34	80.3	19.7	

--- Chemical and physical analyses - profile 26 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
55-40	01	-	-	-	-
40-25	02	-	-	-	58.96
25-0	03	-	-	-	48.24
0-10/20	Ah	58	24	18	12.05
10/20-30	Bw	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	4.3	8.0	-
-	4.1	7.8	-
4.5	3.8	7.8	74
4.6	4.0	8.4	65
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	-	-	-	-	-	-
56.65	1.38	1.08	-	-	-	-
82.50	0.69	0.24	0.39	-	-	4.5
35.70	1.00	0.29	0.13	0.11	4	4.8
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----		-----		
-	2.0	1.6	0.89	45	5.6	67	1	55
-	2.0	1.5	1.07	39	3.6	46	1	+100
6.50	2.0	1.3	0.21	20	2.0	3	1	+100
11.80	2.0	1.0	0.16	29	1.0	1	2	+100
-	-	-	-	-	-	-	-	-

Depth (cm)	Dry bulk dens. (g/cm3)
55-40	0.14
40-25	0.29
25-0	0.68

--- Chemical and physical analyses - profile 27 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
61-58	01	-	-	-	-
58-45	02	-	-	-	-
45-38	03	-	-	-	56.8
38-20	04	-	-	-	54.7
20-0	05	58	22	20	48.2
0-12/26	Ah/Bw	25	55	20	12.1
12/26-32	Bw/C	43	39	18	7.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
-	4.4	-	-
-	3.6	7.5	-
4.2	3.5	7.4	35
4.5	3.6	7.5	44
4.6	4.0	8.3	63
4.7	4.0	9.3	91

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) .kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
92.40	-	0.75	0.83	0.27	-	5.5
84.70	-	0.49	0.45	0.22	-	4.0
34.65	1.31	0.29	0.10	0.10	5	3.0
31.90	0.75	0.39	0.13	0.12	4	6.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) .dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	9.0	2.7	1.03	83	4.8	88	1	23
-	4.5	2.5	0.52	72	6.2	28	2	67
5.50	2.5	1.5	0.37	39	2.8	3	1	+100
4.50	2.0	1.1	0.21	26	2.0	1	1	+100
6.00	2.0	0.8	0.12	32	1.4	1	4	+100
14.00	0.0	0.8	0.12	36	2.6	2	6	+100

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
58-45	8.4	91.6	
45-38	5.1	94.9	
38-20	15.1	84.9	0.27
20-0	35.9	64.1	0.63
0-12/26	80.5	19.5	

--- Chemical and physical analyses - profile 28 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
43-38	01	-	-	-	-
38-20	02	-	-	-	-
20-0	03	-	-	-	66.5
0-15	Ah1/(E1)67		22	21	21.4
15-22	Ah2/(E2)31		45	24	14.7
22-22.3	Bs	-	-	-	-
22.3-45	Bw1	71	15	14	7.0

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
4.4	3.3	7.5	-
3.9	2.8	7.2	13
4.0	3.7	8.5	88
4.3	3.5	7.5	35
-	-	-	-
5.1	4.3	10.4	99

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
94.60	1.31	-	0.90	-	-	-
29.25	1.03	0.88	0.58	0.23	9	3.0
59.45	2.00	0.69	0.27	0.22	5	9.0
33.55	0.94	0.41	0.16	0.12	5	3.5
-	-	-	-	-	-	-
47.85	0.81	0.30	0.10	0.12	3	2.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
1.80	0.2	1.2	0.44	41	4.6	5	1	40
4.00	0.0	1.4	0.26	32	20.2	2	1	77
12.00	1.5	1.3	0.13	8	2.8	1	4	+100
4.00	0.0	1.1	0.15	25	4.0	1	1	+100
-	-	-	-	-	-	-	-	-
2.20	0.0	0.8	0.10	8	2.4	1	9	+100

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
38-20	2.4	97.1	
20-0	7.6	92.4	0.64
0-15	61.0	39.0	

--- Chemical and physical analyses - profile 29 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
27-17	01	-	-	-	-
17-0	02	-	-	-	63.24
0-2	Ah1/(E1)	59	13	28	18.22
2-14	Ah2	61	28	12	6.16
14-14.2	Bs	-	-	-	-
14.2-53	Bw	-	-	-	-

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
-	-	-	-
4.9	3.9	7.5	-
4.6	3.9	8.5	84
5.9	4.5	10.2	98
-	-	-	-
-	-	-	-

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
41.80	3.81	-	0.39	-	-	3.5
40.70	2.69	-	0.29	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
0.50	4.0	1.8	0.50	30	3.4	34	1	+100
6.00	0.0	1.1	0.18	26	3.4	3	4	+100
1.50	0.0	1.0	0.10	7	2.4	1	4	+100
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Depth (cm)	Min. (%)	Org. (%)
17-0	10.9	89.1

--- Chemical and physical analyses - profile 30 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
21-2	01	-	-	-	-
2-0	02	-	-	-	46.1
0-3	Ah1/(E1)	45	25	30	15.0
3-10	Ah2	65	17	18	9.6
10-10.2	Bs	-	-	-	-
10.2-44	Bw	73	19	8	5.1

pH(H2O) pH(KCl) pH(NaF) Phos. ret. (%)

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.9	3.3	-	-
4.1	3.4	7.5	46
4.1	3.7	8.0	75
4.3	3.9	8.7	89
-	-	-	-
4.8	4.2	9.0	98

CEC Ca Mg K Na BS Extract. Acid.
 --- cmol(+) . kg-1 -----

31.90	-	-	0.61	0.17	-	-
30.80	0.88	-	0.58	0.23	-	3.4
37.40	-	0.60	0.77	0.30	-	5.5
38.50	-	-	0.55	0.22	-	2.5
-	-	-	-	-	-	-
33.00	-	-	0.39	0.19	-	1.5

Al Ca Mg K P Zn Mn Cu Fe
 --- cmol(+) . dm3 ----- --- ug/ml -----

2.00	2.0	1.8	0.35	29	4.6	41	1	+100
3.00	0.0	1.1	0.29	21	3.6	2	1	+100
3.70	0.0	0.6	0.12	29	2.0	2	4	+100
4.70	0.0	0.7	0.09	10	2.0	4	7	+100
-	-	-	-	-	-	-	-	-
1.00	0.0	0.7	0.10	7	1.0	4	3	+100

Depth (cm) Min. (%) Org. (%)

21-2	6.3	93.7
2-0	34.2	65.8
0-3	74.6	25.4

--- Chemical and physical analyses - profile 31 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
25-41	O1	-	-	-	-
4-0	O2	-	-	-	51.5
0-15	Ah	79	7	14	19.6
15-58	Bw1	79	11	10	6.4

pH(H2O)	pH(KCl)	pH(NaF)	Phos. ret. (%)
-	-	-	-
-	3.9	7.7	-
4.3	4.0	7.8	91
4.7	4.2	9.3	97

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	0.88	0.74	0.48	0.18	-	3.0
-	1.00	0.61	0.26	0.12	-	2.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
-	-	-	-	-	-	-	-	-
-	2.5	2.5	0.50	17	5.4	73	2	+100
3.00	0.0	1.3	0.19	7	2.0	5	1	+100
1.30	0.0	1.0	0.10	5	1.2	2	1	+100

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
4-0	25.9	74.1	
0-15	65.4	34.6	0.36
15-58			0.45

--- Chemical and physical analyses - profile 32 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
12-2	01	-	-	-	68.6
2-02	02	-	-	-	-
0-1	Ah1	55	19	26	16.6
1-23	Ah2	79	10	11	10.2
23-55	Bw	75	23	12	4.6

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.5	3.2	7.3	10
4.1	3.3	7.7	-
4.3	3.5	8.4	79
4.6	4.0	9.7	97
5.0	4.4	10.8	98

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	2.50	3.13	0.51	0.23	-	3.3
30.25	5.63	2.75	0.51	0.30	30	-
25.85	1.06	0.38	0.26	0.14	7	-
30.25	1.06	0.48	0.26	0.12	6	0.9
-	0.94	0.43	0.13	0.09	-	0.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
2.30	0.5	1.3	0.19	33	4.0	5	1	+100
5.00	1.0	1.3	0.16	19	3.0	3	2	+100
4.50	0.0	0.8	0.12	22	2.8	3	3	+100
2.50	0.0	0.6	0.13	10	1.6	1	4	+100
0.50	0.0	0.6	0.09	10	1.4	1	3	+100

Depth (cm)	Min. (%)	Org. (%)
22-12	5.5	94.5
2-0	46.3	53.7

--- Chemical and physical analyses - profile 33 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
20-2	O1	-	-	-	60.0
2-0	O2	33	50	27	34.3
0-22	Ah	79	8	13	16.1
22-60	Bw	87	6	7	9.1

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.0	3.3	7.6	-
3.9	3.5	8.3	74
4.5	4.1	10.3	98
5.1	4.4	10.7	99

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	1.75	1.88	1.25	0.29	-	-
30.25	1.50	1.00	0.48	0.22	11	3.2
29.70	1.06	0.66	0.29	0.14	7	1.4
33.00	0.94	0.33	0.16	0.10	5	0.2

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml		-----		
5.50	1.5	1.6	0.39	17	7.0	8	2	+100
7.60	1.5	1.3	0.15	19	4.2	3	2	+100
3.50	1.0	0.9	0.09	3	1.8	1	2	+100
1.00	0.0	0.6	0.09	3	1.6	2	1	75

Depth (cm)	Min. (%)	Org. (%)
20-2	14.9	85.1
2-0	48.1	51.9

--- Chemical and physical analyses - profile 34 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
3-0	01	-	-	-	64.3
0-20	Ah1	67	22	11	11.0
20-27	Ah2/Bw1	79	12	9	7.0
27-77	Bw	37	42	21	1.1

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.8	3.7	7.7	-
4.5	4.0	9.7	94
4.9	4.3	10.6	98
5.0	4.3	9.9	89

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	4.75	4.13	1.60	0.26	-	-
24.75	1.13	0.40	0.26	0.16	8	2.8
24.20	0.94	0.34	0.19	0.11	7	1.5
-	1.13	0.30	0.16	0.13	-	1.5

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----		-----		
3.50	3.0	2.0	0.42	22	5.0	24	1	+100
4.50	1.0	1.0	0.10	7	2.0	2	3	+100
2.00	1.0	0.8	0.07	3	1.4	1	2	+100
3.00	1.0	0.8	0.09	3	1.4	2	1	+100

Depth (cm)	Min. (%)	Org. (%)	Dry bulk dens. (g/cm3)
3-0	11.2	88.8	
0-20			0.50

--- Chemical and physical analyses - profile 35 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
7-0	O1	-	-	-	54.7
0-23	Ah	43	50	7	7.0
23-43	Bw1	31	56	13	2.4
43-63	Bw2	31	56	13	0.5

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
4.9	3.9	7.8	-
4.8	4.1	9.8	93
4.9	4.1	9.5	81
5.2	4.0	9.2	60

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+) . kg-1 -----						
-	4.00	6.25	1.64	0.13	-	2.3
-	1.13	0.88	0.19	0.34	-	3.3
-	1.63	1.20	0.29	0.14	-	0.3
-	-	-	-	-	-	-

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+) . dm3 -----				--- ug/ml -----		-----		
0.50	3.5	3.5	0.31	12	8.6	26	1	+100
4.00	1.0	2.1	0.09	7	3.0	2	3	+100
6.50	1.0	1.8	0.15	3	1.4	4	4	+100
8.00	1.0	1.9	0.12	5	1.6	6	1	65

Depth (cm)	Min. (%)	Org. (%)
7-0	18.9	81.1

--- Chemical and physical analyses - profile 36 -----

Depth (cm)		Sand (%)	Silt (%)	Clay (%)	Org. Mat. (%)
17-0	01	67	26	7	49.3
0-63	Ah/Bw	73	16	11	7.8

pH H2O	pH KCl	pH NaF	Phos. ret. (%)
5.2	4.8	9.7	70
5.7	5.3	8.8	19

CEC	Ca	Mg	K	Na	BS	Extract. Acid.
--- cmol(+).kg-1-----						
-	-	-	-	-	-	0.1
-	1.31	1.23	0.16	0.12	-	0.1

Al	Ca	Mg	K	P	Zn	Mn	Cu	Fe
--- cmol(+).dm3-----				--- ug/ml-----				
0.10	15.0	3.2	0.18	12	1.0	9	3	55
0.10	36.5	7.0	0.29	11	2.4	13	1	10

Depth (cm)	Min. (%)	Org. (%)
17-0	28.6	71.4