

Foliar sampling strategy

Targets

- * Carbon and nutrient stocks in the leaf biomass
- * Carbon and nutrient height distributions in the leaf biomass
- * Leaf area, and leaf size and density distribution
- * Leaf area index
- * Carbon and nutrient stocks of woody biomass

Methods

- * Sampling of 1 bag (A4) of leaves of 20 trees from the upper crown
- * Sampling of 1 bag (A4) of leaves of 3 trees in 3 heights: upper crown, middle, lowest branch
- * Scanning of (up to) 10 leaves and determination of dry weight (“needle seed“ program)
- * Hemispherical pictures (20) and computer analysis
- * Sampling of 1 wood core from 1 tree

Leaf sampling

Sampling

- * Sampling of 20 upper crown (climb of up to 5-6 trees)
- * Sampling of leaves of climbed tree in 3 heights
- * Sampling of reachable upper crown samples of surrounding trees

Manpower and time need

- * 1 climber, 1 person on the ground
- * 1 to 1.5 days per plot

Field notes

- * Tag number of sampled tree
- * Measuring of climbed height and tree diameter (dbh), estimation of remaining tree height
- * Estimation of height of surrounding trees
- * Subplot

Limitations

- * Suitable weather conditions for climbs = no hard or continuous rain
- * Tree suitable to climb (spikes, latex, diameter etc.) and surrounded by many other trees

Hemispherical photographs

Sampling

- * 1 m height
- * 15-25 pictures per plot

Field notes

- * Subplot
- * Numbers of trees around

Manpower and time need

- * 1 person + people nearby (dusk)
- * 2-3 hours of suitable weather and light conditions

Limitations

- * Suitable weather conditions for camera = no rain
- * Suitable light conditions = clouds or dusk (dawn)
- * Shape of plot
- * Many batteries,
1 or 2 spare buffer cards

Wood cores

Sampling

- * 1 core of 1 tree outside of plot (as far away as possible)
- * Leave sample of tree for species determination

Field notes

- * Next subplot
- * Tree diameter (dbh)

Manpower and time need

- * 1 person (skilled with drill, and strong)
- * 20-30 minutes

Limitations

- * Hardness of wood

Soil sampling strategy

Targets

- * Carbon and nutrient stocks in the organic soil layer and the mineral soil
- * Carbon and nutrient distributions with soil depth
- * Carbon and nutrient distributions within plot
- * Other soil properties (density, type, texture, groundwater level, etc.)

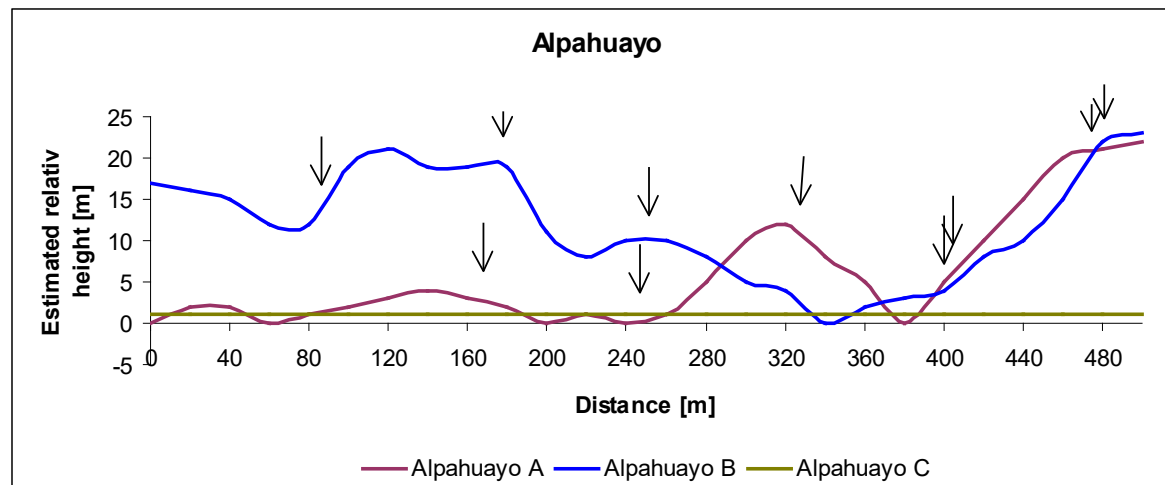
Methods

- * Sampling of 2-5 soil cores per plot down to 2 m depth
- * Description and sampling of 1 soil pit per plot down to 2 m depth
- * Sampling of one soil core per plot in the pit from 2 to 4 m depth

Sampling

- * 2-5 cores per plot
- * Initially grid design, but selection of representative sites subject to topography + avoidance of plot borders

Soil core sampling



Soil core sampling

Field notes

- * Sample: Name of core/plot, depth interval
- * Position: Plot, subplot, GPS-point, local topography, numbers of nearest tagged trees
- * Soil: Maximal depth of sampling, texture, stones, roots, colour, hydromorphic features, ground water level, depth and thickness of hardpan

	Sampling interval [m]		
Organic layer	?	-	0
Mineral soil	0	-	-0.05
	-0.05	-	-0.10
	-0.10	-	-0.20
	-0.20	-	-0.30
	-0.30	-	-0.50
	-0.50	-	-1.00
	-1.00	-	-1.50
	-1.50	-	-2.00

Soil core sampling

Manpower and time need

- * 2 persons,
for carrying better more
- * About 0.5 day for plot exploration
after plot setup
(one side + cross connections)
- * 1-2 cores per day,
3 if high ground water level or
sandy soils

Limitations

- * Ground water level (especially in
sandy soils)
- * Soil texture (heavy loam or clay,
hardpan, stones)
- * Way to walk to plot and back
(with auger & samples)
- * Weather (continuous rain, light
conditions during rainy periods)
- * Open space (to turn auger)
- * Beasts

Soil pit sampling

Sampling

- * 1 pit per plot
- * Selection of representative site, 20 away from plot

Field notes

- * Sample: Name of pit, depth interval
- * Position: Plot, nearest subplot, GPS-point, local topography
- * Soil description per visible genetic horizon: Maximal depth of sampling, texture, stones, roots, colour, hydromorphic features, ground water level, depth and thickness of hardpan
- * Pictures

Soil pit sampling

	Sampling interval		
	[m]		
Organic layer	?	- 0	
Mineral soil	0	- -0.05	density
	-0.05	- -0.10	
	-0.10	- -0.20	density
	-0.20	- -0.30	density
	-0.30	- -0.50	density
	-0.50	- -1.00	density
	-1.00	- -1.50	density
	-1.50	- -2.00	density
	-2.00	- -2.50	
	-2.50	- -3.00	
	-3.00	- -3.50	
-3.50	- -4.00		

Soil pit sampling

Manpower and time need

- * 3 persons (2 in pit, 1 outside)
- * 1-1.5 days for digging, 4 hours to close
- * 0.5 day for description and sampling

Limitations

- * Representative site must be chosen before core samples are taken due short time interval per plot
- * Sampling should be done immediately after digging because of frequent night rain (walls collapse, ground flooded)
- * Core augering in pit is only possible down to 4 m depth (2*2*2 m pit)
- * Ground water level
- * Soil texture (heavy loam or clay, hardpan, stones)
- * Weather (continuous rain)

Conclusions

Field work results

- * Planned grid sampling of soils failed
- * Soil and biomass sampling worked well with 3 persons available + a skilled climber
- * Short time interval for plot was limiting
- * Density sampling is not possible using the augers
- * Physical strength is a limiting factor, especially if there are no “holi” days
- * Plot setup by botanists was very helpful in terms of finding representative sampling sites

Remaining questions

- * Is the amount of cores representative for the plot? (spatial heterogeneity)
- * How much material per soil depth interval will be needed for further analyses?
- * Is the quality of the hemispherical pictures suitable for computer analyses of the leaf area index?

Soil sample storage and transport preparation

Consideration

- * Samples should be dried as fast as possible (maximal temperature 70° C)
- * Samples will not dry at all without heating them
- * Closed bags or field wet samples should not be exposed to direct sunlight
- * Samples must be crushed before subsampling (clay rich samples are plastic when wet and must be crushed into bigger pieces to accelerate the drying process)
- * Samples must be kept safe from herbivores (insects)
- * Leaf samples for scanning must be stored pressed in paper

Sample preparation - Needs

Soil

- * Available drying space
- * Electricity supply for balance (density)
- * Crushing space and tools, and clean surrounding (water, paper tissues)
- * Boxes to store samples

Leaves

- * Electricity supply (microwave, computer, scanner, balance)
- * Size of leaves
- * Air moisture (dried samples, computer, scanner)
- * Buffer (camera cards)

Sample preparation - Time need

Soil

- * 1-3 days to dry a single soil sample by heating (in Peru: only during the day)
- * 20 minutes to crush and subsample a dry soil sample
- * Organic soil samples should not be dried in a microwave
- * 20 minutes to dry and weigh each density sample (microwave)

Leaves

- * 15-25 minutes to dry, crush, and subsample a sample (microwave)
- * Pressing of leaves (removal of leafstalk) must be done in the field (1-2 persons, evening or morning after sampling)
- * Scanning: 1 person, 5-10 minutes per scan (does not equal sample), Peru = 10 days
- * Drying and weighing: 1 person, 10 minutes per scan

Factors limiting soil and foliar sampling

- * Augering equipment is heavy
- * Wet soil is heavy
(+ augering equipment)
- * Soil sampling and carrying persons get very dirty and do hard physical work
- * Biomass samples are very bulky and therefore hard to carry
- * Carrying frames or big backpacks are not suitable for the field
- * Samples will not dry in the field

Health issues

- * Pulling out the auger is very exhausting after about 1 m soil depth and requires enormous physical strength
- * Pulling out the auger is very bad for your back, especially if augering site is wet and/or on a slope

Logistics - Sample preparation for export

Do it yourself

- * Time need 7-10 days ~ amount of samples and requiered subsamples
- * Samples stay wet until the last week
- * Many heavy (wet) samples must be tranported from field sites at once

Logistics - Sample preparation for export

Do it yourself

- * Time need 7-10 days ~ amount of samples and requiered subsamples
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Logistics - Sample export

Questions

- * Is sample export possible by law?
Find out about laws before sampling starts
- * Which papers from whom are needed?
Find and contact the people in charge before sampling starts
- * Do these people know about this project?
Find an exporting company
- * Will these people receive samples? How?
Bring official papers from Europe
- * How do the samples get exported?