Capturing Dendrometric Variables Using Mobile Phone Applications

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MOTI

> Swiss army knife for forest inventories and forest growth

The tool: always at disposal, simple to use, handy

- Basal area
- Number of stems
- Tree height
- Growing stock

Measurements: quick, easy, reliable, georeferenced

Added-value of the collected data directly available in the forest

Extensions:
- More detailed data on the current stand state
- Further development of stand without intervention

Source de la photo: www.victorinox.com (10.04.2014)
Growing stock?  
Tree height?  
Stem density?  
Basal area?

MOTI: easily quantify what you see in the forest
Growing stock?  
Tree height?  
Stem density?  
Basal area?

MOTI: easily quantify what you see in the forest

Sample plot: peuplement érables

Position [m]: 602330 / 204630

Summary of the sample plot:
Basal area [m²/ha]: 40
Stem number [-/ha]: 833
Dom. height [m]: 27
Timber stock [m³/ha]: 438

The timber stock was calculated using the form-height-values of the main tree species in the Swiss forest calendar (see Help for details).

Quadratic mean diameter [cm]: 24

Tree species composition based on G:
- Larch: 5%
- Ash: 15%
- Sycamore: 45%
- Oth. dec.: 35%
Measurement of basal area with MOTI

1. Starting point

2. Target trees

3. Count or don’t

4. Check all trees
**Measurement of the basal area per ha (G)**

(1) **Starting point**
Mark the *sampling point* by e.g. sticking a branch in the ground.
Start with the *nearest tree* in order to remember where you started off.

(2) **Target the trees at 1.30m height**

(3) **Count a tree or don’t**
The *slope* is automatically taken into account by built-in sensors.

(4) **Check all the trees**
… in the nearby surrounding area by rotating the Smartphone *360° around* a specific location.
Counting factor $k = 4$

The distance between the two green marks is automatically adapted to the selected counting factor.
Counting factor $k = 2$
The distance between the two green marks is calculated based on the camera angle.
Essential advantage of camera: possibility to zoom in
Essential advantage of camera: possibility to zoom in
Vertical orientation of the smartphone automatically taken into account by built-in sensors
> distance between the two green marks adapted accordingly
> particularly important in the case of slope
Settings: ex. counting factor $k$

Online-Help (Measurements and Calibration)

Single measurements without saving the values

Save the results in a sample plot, including its location with GPS
Determination of $k$ (counting factor)
Determination of $k$ (counting factor)
Use of **embedded sensors** to simplify measurements (e.g., flexible count factor, slope)

Use of the **touch screen** for easy measurement taking (zoom in/out, counting button)

**Calibration** procedure integrated in the app

**Data** synchronization with a server, convenient data download at the office or direct data export
SiWaWa embedded in MOTI: forest dynamic at your fingertips

- Growth dynamic?
- Dead wood?
- Thinning urgency?
- Stability?
- Productivity?
- Wood quality?

**Diagram:**
- Basal area (G)
- Maximal stand density
- Stand basal area
- Guideline
- Mortality

**Simulation**
SiWaWa: clear silvicultural references, anticipate further development …

- Maximal stand density
- Stand basal area
- Guideline
- Mortality

Growth dynamic?
Dead wood?
Thinning urgency?
MOTI > synergies with other apps to support close-to-nature, multifunctional and sustainable forest ecosystem management

Forest dynamics at your fingertips
Growth simulation model based on the input of MOTI
Example of application ...

Toolkit to elaborate stand maps from remote sensing data (e.g. LiDAR, Sentinel-2)

Management tool for goal-oriented and efficient management of forest ecosystems
MOTI > further developments ...

Forest Glass > based on Google Glass
> New ways to interact with computers

Forest Time Machine
> Forest Inventory based on 360° photography
Innovation for change ...

- More accurate perception of forest ecosystems (quantify what you see, get a detailed overview of a given forest area, ...)
- Ease comparisons with similar situations, exchanges among professionals, knowledge increase
- Support for silvicultural decision making, basis for optimization of production systems
Thank you very much for your attention!

Download on Google Play Store:

Download on Apple App Store:

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MOTI: a pocket-sized tool for forest inventories

An application developed by Swiss researchers at the School of Agricultural, Forest and Food Sciences (HAFL) makes it possible to collect forest inventory data, such as the basal area or tree height, using a smartphone.

MOTI is a smartphone application that enables users to record quantitative data on what they see in the forest with just a few clicks – especially the wood stock, basal area, number of trees per hectare and growth increment. Try to estimate these key figures for the scene in figure 2, taking the person in the middle of the picture as a reference.

Without experience, making such estimates is anything but simple. One of the main goals of MOTI is to help users train their eyes to improve their personal assessments by being able to measure those figures quickly and easily. The app is also intended to provide decision support in the field (for marking, planning of silvicultural interventions, ...).

With MOTI, single or clustered sample plots in a stand can be measured and even local inventories performed (e.g. one sample plot every 100 m). The statistical error is then continuously computed. The app also includes a growth model for simulating the medium-term development of the investigated stand. The data collected is saved on a server and can later be downloaded from the office in Excel format.
Les smartphones au service de la forêt
par Olivier Nirot
Expertise et gestion forestière

La forêt n’est pas immuable, elle évolue avec la société, ses besoins et ses technologies. Les connaissances de la forêt, la façon de l’appréhender et sa gestion évoluent aussi. Il n’y a pas de longtemps, la mesure de paramètres simples et très utiles à la prise de décision nécessitait des compétences techniques, un outillage coûteux et parfois beaucoup de temps. Les progrès technologiques rendent aujourd’hui certaines de ces mesures accessibles à tout le monde pour un coût « réduit ». En effet, les smartphones et les tablettes sont les nouveaux outils suisses du forestier car ils permettent de répondre à bon nombre de demandes de mesure, toutes que les dispositifs pour scanners de la HAFL ne peuvent pas ou plus traiter. Les smartphones, l’application gratuite MOTI, sont devenus un outil de référence pour mesurer des paramètres forestiers.

MOTI – Waldinventur im Taschenformat

MOTI – Waldinventur im Taschenformat

MOTI, l’inventaire forestier mobile
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MOTI, les inventaires forestiers dans la poche

MOTI, les inventaires forestiers dans la poche

La technologie booste la cartographie

Sylviculture

MOTI – EIN Tool für die Waldinventur im Taschenformat

MOTI – EIN Tool für die Waldinventur im Taschenformat

Les inventaires forestiers dans la poche

Surface terrière d’un peuplement et sa hauteur avec votre smartphone, c’est possible grâce à MOTI. Il peut être téléchargé sur Google Play Store ou sur l’App Store de l’iPhone.

MOTI (mobile timber cruise)

Fare l’inventario forestale con tablet e smartphone

Strumenti & Applicazioni

MOTI (MOBILE TIMBER CRUISE)

Fare l’inventario forestale con tablet e smartphone

A cura di Massimo Bidini

Pratique

STRUMENTI & APPLICAZIONI

Dossier/Forêt

Agri

Dossier/Forêt

Agri

Dossier/Forêt

Agri

Dossier/Forêt

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Dossier/Forêt

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Dossier/Forêt

Agri
Enter the target coordinates in WGS84 format (e.g. 7.43864 / 46.95108) or as Swiss coordinates (e.g. 600000 / 200000)

Target coordinates:
E: 696750.0  
N: 245200.0

Raster navigation:
E: + -  
N: + -

Current coordinates:
E: 696737  
N: 245183  
4m

Distance: 21m  
Orientation: 38°
Sich fit machen für die Grundflächenbestimmung ...

Parcours

Parcours in 3 Teilen mit insgesamt 18 Probeflächen, deren Zentren mit Pfählen aus Eichenholz gekennzeichnet sind.

1. Teil: 3 Probeflächen mit gekennzeichneten Bäumen je nachdem ob sie mit k=4 (rote Punkte) bzw. k=2 (orange Punkte) gezählt werden müssen.
Main approach

Diffusion Innovation Theory
(Rogers 1995, after Lin and Chen 2012)

- Relative advantage to the current situation?
- Compatibility of the current structure?
- Degree of complexity and the corresponding perceived difficulty of using the new technique?
- Trailability before purchasing?

System Thinking
- Delegation (what has to be considered, what not?), interface to other systems
- Main elements and interconnections (what is essential?)

Proceeding from the whole to the composite parts
- Maintain an overview, do not get lost in details
- Step-by-step with regard to complexity, learning process

Thinking in variations
- Do not only focus on the first solution
- Be creative and self-critical with regard to one's own solution
- Try to find the best possible solution

Development process:
- Step-by-step with increasing formalism and functionalities: Brain-storming (e.g., on white board) > paper prototyping > modelling techniques with simple symbolism (e.g., data flow diagram, flow chart) > UML (e.g., activity diagram, class diagram) > test and demo prototype > consolidation
- Developer team with >= 5 members to mix skills, competencies and points of view (background, languages)
- Stakeholder involvement from the beginning on a regular basis
Research and Development with Practitioners ...

Added value? Simplicity? Usability? Trialability?

From expectations to design of the user interface for tests in the forest
Uneven-aged: what reference to maintain demographic equilibrium?

Typical Plenter-forest

Former Plenter-forest without any intervention for 50 y

Basal area:?
m²/ha

Basal area:?
m²/ha
Uneven-aged: what reference to maintain demographic equilibrium?

Basal area: 35-40 m²/ha

Basal area: 75-80 m²/ha
Uneven-aged: what reference to maintain demographic equilibrium?

Basal area: 35-40 m²/ha

Basal area: 75-80 m²/ha