особу. Отримані результати ляжуть в основу розроблення методики оптимального планування охорони праці з метою зменшення до мінімумів професійних ризиків. Зазначимо, що приведені розрахункові залежності носять загальний характер і можуть бути використані для оцінки виробничого травматизму не лише на підприємствах лісової промисловості.

**Ключові слова:** регресійний аналіз, виробничий травматизм, коефіцієнт кореляції, коефіцієнт частоти травматизму.

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## REALIZATION OF STATISTICAL INVENTORY OF THE VIRGIN BEECH FOREST IN UHOLSKO-SHYROKOLUZHANSKYY MASSIF

This article provides a short overview on the statistical inventory of the virgin beech forest in the "Uholsko-Shyrokoluzhanskyy massif" which was held in July-August 2010 as a result of Swiss-Ukrainian cooperation.

**Keywords:** forestry inventory, virgin beech forest, WSL, CBR, UNFU, method, tree stand characteristics, experience, Ukrainian forestry, Ukrainian state statistical inventory of forest stands.

Carpathian mountain system is one of the biggest biologically diversified systems on the European continent. In XX century an intensive nature usage took place in the Ukrainian Carpathians, but several territories saved the unique forest plantations which have to be explored in the near future. Among all those territories there are such called virgin forests (also known as primary forest, primeval forest or ancient woodland) consisting of European Beech *Fagus sylvatica L.* [1]. Since 2007 these virgin forests belong to the UNESCO natural heritage.

Currently these unique areas are under the state protection and belong to the Carpathian biosphere reserve. The largest beech virgin forests grow on the 15580 ha territory in the "Uholsko-Shyrokoluzhanskyy massif". It is located in the beech forests zone, with the prevailing zonal beech forests, and forming the upper forest line at an altitude of 1200-1300 m. The fragments of forest with *Duschekia viridis* are found higher, mainly in hollows. In the optimum ecological conditions, the species of beech is marked by the high vitality and form highly productive plantations with a stock of timber, which is more than 600 $m^3$/ha. The communities of *Taxeto-Fagetum* and *Juniperetum sabinae*, which are unique for the Carpathians, are preserved in the limestone ledges. Such relict phytocenosises as *Quercetum petreae*, *Fageto-Tilietum platiphyllae*, *Piceetum abietis* and *Betuletum pendulae* are also represented here [5]. Plantation is characterized with the great biodiversity of flora and fauna, but the greatest interest represent beech natural plantations, which are not influenced with the human activity [4]. The exploration and monitoring of these territories will make it possible to gain new knowledge about the structure of forests, which develop without economic intervention [6-15].

For the purpose of statistical inventory of Uholsko-Shyrokoluzhanskyy massif the cooperation between Swiss Federal Institute for Forest, Snow and Landscape, Birmensdorf (Eidg. Forschungsanstalt für Wald, Schnee und Landschaft WSL, Birmensdorf), Carpathian Biosphere Reserve (Rakhiv, Ukraine) and Ukrainian National Forestry University (Lviv, Ukraine) took place during July-August 2010. Ukrainian and Swiss scientists and students participated in the research.

The method of research was based on the document "Statistical inventory of Swiss national reserves – method of establishing sample plots, 03.02.2010 version"

(Tinner et al. 2010), which was based on the method of realization the third Swiss state statistical forest inventory (LFI 3, Keller 2005) [3].

All working groups (each group consisted of 2 persons: Swiss and Ukrainian) were well equipped with the modern equipment and gadgets, such as: SUUNTO clinometers and compasses for angle and exposition measurements; Vertex IV for the height measurements; Meridian 400 gon compass for measurements of azimuth from the center of sample plot to each tree; Garmin eTrex Summit HC GPS and orthorectification images of territory for the orientation and reaching sample plots; software of Trimble Juno SB for the accurate coordinates measurements; electronic basal area factor-scope and dendrometer Criterion RD 1000 for the diameter on 7 m height measurements; Hagloff /Mantax 80 cm/calipers; knives, poles, tripods, measure tapes, etc.

According to that method, the 445×1235 m raster grid was designed for the whole inventory area.


***Fig. 1. The scheme of the raster grid***

As it shown on the Fig. 1, distance between two nearby sample plots (territory of each SP equals 500 $m^2$) was ~100 m, and distance between two rows was approximately 1,5 km [2]. Besides, working groups were given the orthorectification aircraft images with sample plots and coordinate system (World Geodetic System (WGS84) was chosen as main coordinate system, because 2 different kinds of GPS-receivers were used for founding the sample plots – Trimble and Garmin). These images were used as additional materials for orientation and founding sample plots. The SCSP (south center of sample plot) was found with the help of GPS-receiver, then 20 m distance from that point to north was measured and new point was fixed with pole as center of sample plot. Besides that, center of sample plot was fixed to the 3 nearest trees and its coordinates were marked from GPS-receivers. Azimuth from center of sample plot to each tree was measured with the help of Meridian 400 gon compass. This will allow finding center of sample plots and measured trees easily in future.

All researches had a list of tasks to do during the inventory, f.e.: to reach the sample plot; to mark and identify the sample plot; to identify and sum up the anthropogenic influence on the sample plot; to receive the forest and inventory indicators of tree stands, regeneration and dead wood (breast height diameter, tree height, diameter on 7 m height, dead wood taxation, tree status, tree species, growth form, crown length, etc.).

All data from sample plots was written to 6 different forms [3]:

*Form 1. Navigation and sampling decision.* Sample plot number, date, starting point for navigation, declination and compass deviation, remarks concerning navigation, sampling decision and other basic information was written in this form. *Form 2. Sample plot.* Information about sample plot (its altitude, inclination and radius), Trimble measuring point, sketch of sample plot, photos of sample plot, boundary lines, eye-catching objects and remarks were mentioned here.

*Form 3. Sample trees.* Tree stand inventory with mentioning of such characteristics as tree number, BHD, tree status, species, azimuth, distance and inclination from sample plot center, crown layer, growth habit, crown length, crown breakage, dead wood in crown, bark lesion, cracks, holes in stem, polypore's on stem, tree height, height of crown base, diameter on 7 m height and others. *Form*

*4. Regeneration.* Information regarding regeneration survey, f.e. position of regeneration subplot, distance from sample plot center, inclination of subplot, stone/rock %, humus layer, shade, amount of regeneration on 3 radiuses (horizontal 1,26 m, 1,78 m, 2,52 m) etc. *Form 5. Dead wood transects.* Direction of dead wood transects, inclination of transect, length of transect, information about trees, which cross the transect (its number, 2 diameters, angle, species and degree of decay) were written in this form. *Form 6. Assessment of interpretation area.* Site characteristics (slope aspect, relief) traces of anthropogenic use, root plates, identifiability of former root plates, gaps, structural characteristics, stand density and other features were mentioned in this form.

Schematic view of the sample plot is shown on picture 2. Real radius of sample plot was corrected according to the inclination of each area, which was measured during filling Fig. 2. All received data was soon digitized and saved in the data bases by appropriate workers. The use of this method on 400 sample plots provided receiving of such characteristics as: main forest and inventory indicators of tree stands (density of stand, absolute fullness, volume, diameter distribution, composition etc.). stock and degree of decay of dead standing and lying wood; structural indicators of tree stands, which are especially valuable for the biodiversity rating; vertical and horizontal structure of tree stand (tree storey and placement); density and structure of regeneration, its viability, main biometrical indicators); impact of natural disasters on the dynamical processes in beech primary forest; level of the anthropogenic influence on beech primary forest; influence, which can threaten the integrity of primary forest in the future.

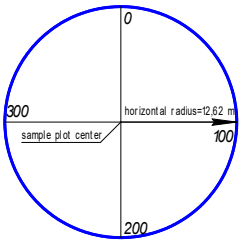


***Fig. 2. The schematic view of the sample plot***

So, in 2010 results of statistical inventory of Uholsko-Shyrokoluzhanskyy massif's virgin forest were received for the first time. Inventory was held according to the method, which was developed by Swiss Federal Institute for Forest, Snow and Landscape. These results accurately reflect the present-day condition of the biggest virgin forest massif in Europe – the Uholsko-Shyrokoluzhanskyy massif.

Nowadays results of statistical inventory are the base for:

- monitoring of the beech virgin forest's development and it's dynamics of existence;
- comparison of growth processes and overall development with man-held forests, European natural reserves, apart forest massif "Sihlwald" near Zurich (Switzerland);
- investigation of the natural structure, biological diversity, genetic structure and natural processes in undisturbed forests which can benefit the nearnatural management of exploited forests.

Experience, which was gained during the statistical inventory, is extremely valuable; it can be used for realization of the first Ukrainian state statistical inventory of forest stands.

## References

1. **Old-growth forest** http://en.wikipedia.org/wiki/Old-growth_forest.
2. **Stichprobeninventur Uholka-Schyrokyj Luh** http://www.wsl.ch/fe/walddynamik/projekte/uholka/index_DE.
3. **Stichprobeninventur im Buchen-Urwald Uholka-Schyrokyj Luh** – Anleitung für die Inventur 2010 http://www.wsl.ch/fe/walddynamik/projekte/uholka/aufnahmenaleitung_de.pdf.
4. **Uholsko-Shyrokoluzhanskyi protected massif** http://cbr.nature.org.ua/new_e.htm.
5. **Virgin forest of Uholka.** Nature Guide to the Largest Virgin Beech Forest of Europe. A UNESCO World Heritage Site http://www.wsl.ch/dienstleistungen/publikationen/pdf/9126.pdf.
6. **Gayda S.V.** Recovered wood is additional resource of raw material // Forestry, Forest, Paper and Woodworking Industry. – Lviv: UNFU. – 2011, 37.1:238-244. (in Ukr.).

7. **Gayda S.V.** A problem of wood raw material is in Europe and Ukraine // Forestry, Forest, Paper and Woodworking Industry. – Lviv: UNFU. – 2007, 33:55-63. (in Ukr.).

8. **Gayda S.V.** Research of concentration of operations is in modern furniture Productsion // Forestry, Forest, Paper and Woodworking Industry. – Lviv. – 2007, 33:73-79. (in Ukr.).

9. **Gayda S.V., Maksymiv V.M., Tunytsya T.Yu.** Elaboration of post-consumer wood classifier // Forestry, Forest, Paper and Woodworking Industry. – Lviv. – 2008, 34:55-68. (in Ukr.).

10. **Gayda S.V.** Chemical compound and degree of its contamination as the basis to systematization of post-consumer wood / Forestry, Forest, Paper and Woodworking Industry, 2008, 34:68-79. (in Ukr.).

11. **Gayda S.V.** Potential of post-consumer recovered wood and possible ways of it using in Ukraine // Forestry, Forest, Paper and Woodworking Industry. – Lviv. – 2009, 35:63-83.

12. **Gayda S.V., Maksymiv V.M.** From recycled post-consumer wood towards prime quality particleboard // Forestry, Forest, Paper and Woodworking Industry. – Lviv: 2010, 36:57-77.

13. **Gayda S.V.** A comparative analysis of physical-and mechanical parameters of variously-designed Glued Boards made of post-consumer Recovered Wood / Forestry, Forest, Paper and Woodworking Industry. – Lviv: UNFU. – 2010, 36:81-91.

14. **Gayda S.V.** Comparative analysis of bending particularities for various post-consumer wood species and age categories // Forestry, Forest, Paper and Woodworking Industry. – Lviv: UNFU. – 2011, 37.1:84-88. (in Ukr.).

15. **Gayda S.V.** The effective use of post-consumer wood is basis for diminishing of $CO_2$-emission // Scientific Herald. – Lviv: UNFU. – 2009, 19.14:72-89. (in Ukr.).

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## Статистична інвентаризація букових пралісів угольсько-широколужанського масиву

Наведено характеристику статистичної інвентаризації букових пралісів Угольсько-Широколужанського масиву Карпатського біосферного заповідника, що проходила у липні-серпні 2010 року у рамках співпраці між Швейцарським федеральним інститутом досліджень лісу, снігу і ландшафтів, Бірменсдорф (Eidg. Forschungsanstalt für Wald, Schnee und Landschaft WSL, Birmensdorf), Карпатським біосферним заповідником (м. Рахів) та Національним лісотехнічним університетом України (м. Львів). Проведено короткий огляд методики, що використовувалась інвентаризаторами для збору даних у польових умовах та їх подальшого зберігання і обробки. Оскільки ,на даний час загальнодержавна інвентаризація лісів України не проводилась ще з радянських часів, пропонується звернути увагу на досвід, отриманий у співпраці із кваліфікованими швейцарськими лісівниками та підготувати методику, яка може покласти початок загальнодержавній інвентаризації лісів незалежної України, що, у свою чергу, приведе до більш якісного та оптимізованого ведення лісового господарства.

**Ключові слова:** лісова інвентаризація, букові праліси, WSL, КБЗ, НЛТУ, методика, характеристики деревостану, досвід, українське лісове господарство, загальнодержавна інвентаризація.

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## THE PROSPECTS FOR THE ADVANCEMENT OF THE PROCESS OF ELECTRO-SPARK TREATMENT

The article describes the main lines of the advancement of electro-spark treatment (EST) process: development of new electrode materials and devising new methods for producing the known materials, additional treatment of electro-spark coatings (ESC) by various methods, the application of the EST method in combination with other methods of treatment, feeding surface-active materials to interelectrode space, physical- and mechanical action on the electrodes, design upgrading of the EST plants and improvement of their electrical characteristics.