

# Assessment of biological productivity of forest in the National natural park 'Holosiivskiy' (based on the hardwood species assessment)

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## Introduction

Forested areas of National natural park «Holosiivskiy» (NNP) play an important role in carbon sequestration and environmental rehabilitation of Kyiv territory. The aim of research is to develop models to be able calculate volumes and components of phytomass of hardwood species (*Q. robur* and *C. betulus*) in the conditions of NNP «Holosiivskiy» forest stands.

## Area of research

National natural park «Holosiivskiy» is situated in Kyiv, Ukraine. The total forest area of the park is 4004,92 ha with the growing stock 1035,95 m<sup>3</sup>. *Pinus sylvestris* (*P. sylvestris*), *Quercus robur* (*Q. robur*), *Carpinus betulus* (*C. betulus*) and *Alnus glutinosa* (*A. glutinosa*) play the main role in the canopy cover formation.

## Methodology

The most adequate way to estimate phytomass and carbon sequestration of forests is to use large scale data of standing stock and mathematical models. Practical realization of this approach is tightly connected with finding coupling coefficients of phytomass components and stem volume based on experimental data, which characterizes bioproductivity of National natural park «Holosiivskiy».

## Results

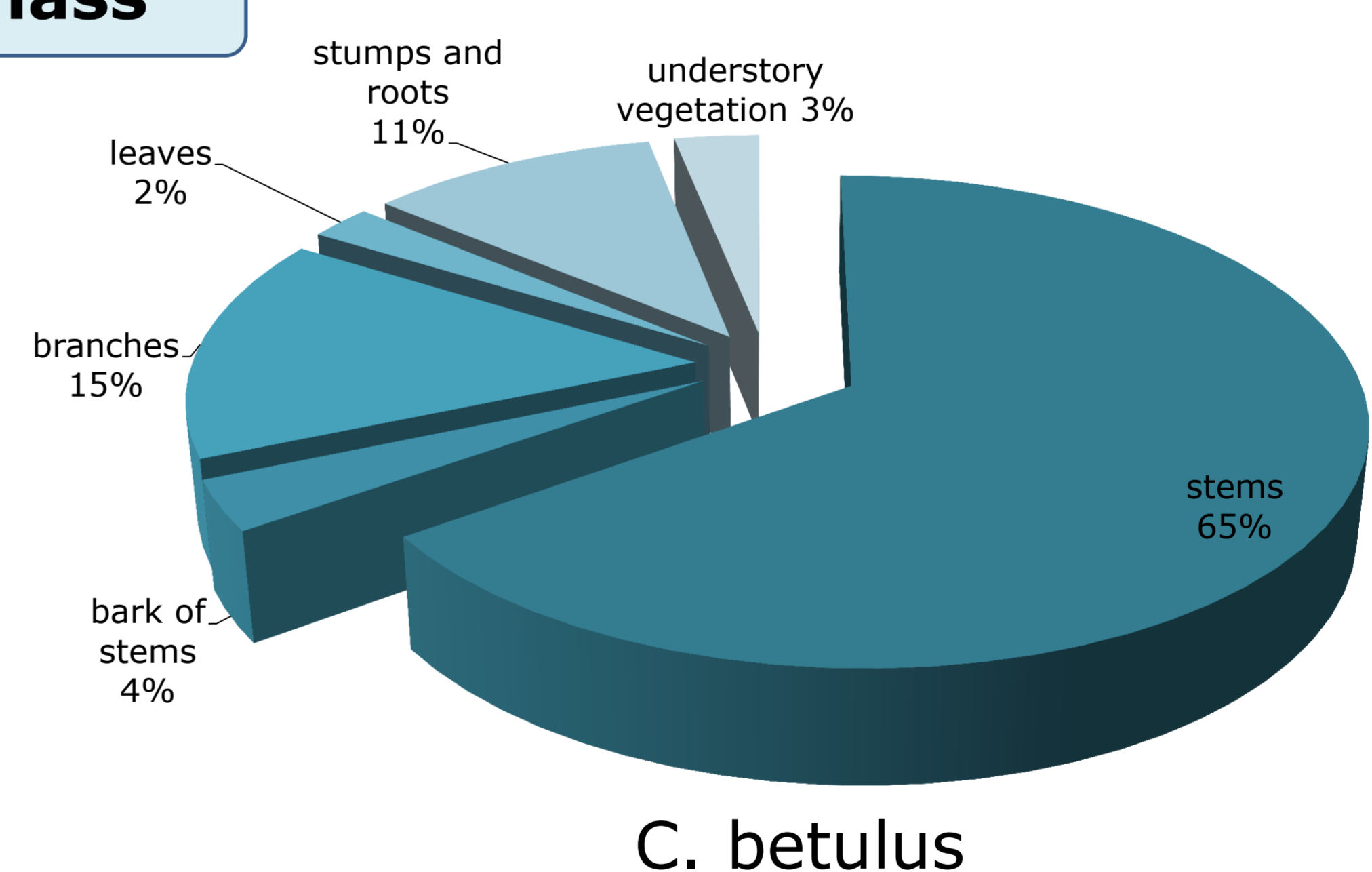
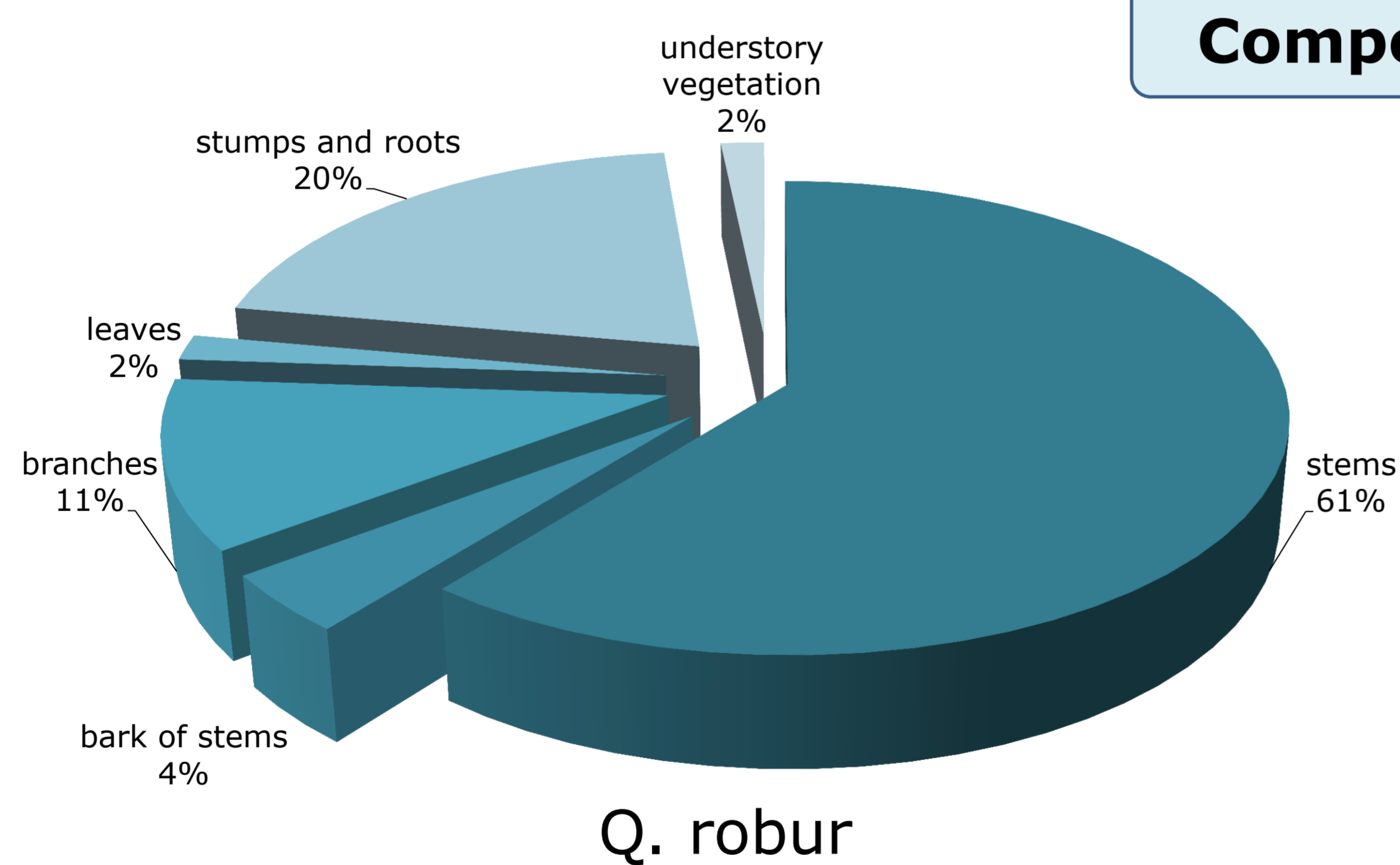
### Models conversion coefficients of phytomass fractions

Model number	Regression model	R <sup>2</sup>
<b>Q. robur</b>		
1	$R_{v(s)} = 41212368,50 \cdot B^{-5,869} \cdot A^{0,083} \cdot p^{0,806}$	0,93
2	$R_{v(b)} = 314737,887 \cdot B^{-4,330} \cdot A^{-0,292} \cdot p^{1,116}$	0,61
3	$R_{v(br)} = 1,259E+12 \cdot B^{-7,433} \cdot A^{0,364} \cdot p^{6,541} \cdot \exp(-0,008 \cdot A + (-7,019 \cdot P))$	0,97
4	$R_{v(l)} = 189,024 \cdot B^{-2,703} \cdot A^{-0,361} \cdot p^{-0,642}$	0,82
<b>C. betulus</b>		
5	$R_{v(s)} = 223,449 \cdot D^{2,966} \cdot H^{-6,874} \cdot \exp(-0,116 \cdot D + 0,381 \cdot H)$	0,63
6	$R_{v(b)} = 0,153 \cdot D^{-1,596} \cdot H^{-0,011} \cdot \exp(0,064 \cdot D + 0,072 \cdot H)$	0,56
7	$R_{v(br)} = 8,570E+11 \cdot D^{5,120} \cdot H^{-22,165} \cdot \exp(-0,256 \cdot D + 1,289 \cdot H)$	0,69
8	$R_{v(l)} = 7,684 \cdot B^{-1,734} \cdot A^{-1,505} \cdot p^{-2,544} \cdot \exp(0,036 \cdot A + 2,597 \cdot P)$	0,59

### Biological productivity of hardwood stands in park

Tree species	Q. robur	C. betulus
Area, ha	327,99	212,2
Growing stock, th.m <sup>3</sup>	57,45	37,93
Phytomass	total, thou.tons	76,613
	density, kg·(m <sup>2</sup> ) <sup>-1</sup>	13,22
Carbon dioxide	total, thou.tons	38,178
	density, kg·(m <sup>2</sup> ) <sup>-1</sup>	6,59

### Components of phytomass



## Conclusions

- Models obtained for the *Q.robur* and *C.betulus* were regression functions with determination coefficients (R<sup>2</sup>) between 0.560 and 0.970. The statistical significance of the results confirms the accuracy of the regional estimates provided by these models.
- An average carbon density on 1 hectare of forest covered land is 6,7 kg·(m<sup>2</sup>)<sup>-1</sup> for both tree species, which is close to the mean value for Ukraine – 7,9 kg·(m<sup>2</sup>)<sup>-1</sup>.
- The results of the estimation of the phytomass and carbon dioxide of forest stands of the NPP «Holosiivskiy» will be an important addition to the existing information database of environmental monitoring and can provide the ecologically balanced forest management in the region of research.

## Publications

1. Lakyda P. Prognostic assessment of bioproductivity of NNP "Golosiivskiy" [electronic resource] / Lakyda P., Dubrovets B. // Forestry and park gardening. – 2015. – №6. – Access: [http://ejournal.studnubip.com/zhurnal-6/ukr/lakyda\\_dubrovets/](http://ejournal.studnubip.com/zhurnal-6/ukr/lakyda_dubrovets/).
2. Dubrovets B. Experimental base of empirical data for the bioproductivity assessment of NNP «Holosiivskiy» / Lakyda P., Dubrovets B. // Scientific herald of NULES of Ukraine. series: forestry and decorative gardening. – 2016. – № 255. – p. 46 – 53.
3. Lakyda P. Qualitative indexes of phytomass components evaluation of NNP «Holosiivskiy» European hornbeam stands / Lakyda P., Dubrovets B. // Scientific Bulletin of UNFU. – 2017. – № 27.3. – p. 11 – 14.
4. Lakyda P. Biological productivity of National natural park «Holosiivskiy» hornbeam stands problems of silviculture and forestry: a collection of scientific papers of Institute of Forest at the National Academy of Sciences of Belarus.- 2017. – №77. – p. 88-95.