2.1.3 Forestry

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Introduction

During the PRISM 2003 field expedition also a survey to collect input data for the forest model FORGRA (Jorritsma et al. 1999) has been carried out, being part of the B4 work package. Information was gathered about the dimensions of individual trees. The field survey was carried out by Pieter Slim, assisted by Theo van der Sluis, Svetlana Degteva, Harald Leummens, Stef van Rijn and Tatiana Pystina. The weather conditions during the field expedition were excellent for the type of research, as was the phenological state of vegetation.

Data collection

Old-growth boreal forest in the Upper Pechora.

In order to run the forest model, there is a need for data from the tree layer, the shrub layer, and the herb layer. Data about the herb layer are collected during the standard vegetation survey executed as part of the B1 work package. Sites for forest model data collection were chosen in the direct vicinity of sites where vegetation was investigated, using a so-called phytosociological or vegetation relevé (describing the presence and abundance of trees, vascular plants, bryophytes and lichens). Additionally, at the same sites, data on entomofauna and soils were collected, using similar plot numbering. Only in about half of all phytosociological relevés (n=131) it was possible to collect forest ecological data (n=57), as the vegetation did not always consist of forests, but also of peat bog, waterbody, sandbank, gravel bank, shoreline vegetation, ruderal vegetation, arable land or meadow. In some cases, a lack of time appeared a limiting factor, as collecting forest ecological data was time consuming and required two persons.

A standard set of input data was collected for every individual tree in a standard-sized plot (preferably 400 m²): age (yrs), height (m), crown base (m), diameter at breast height (cm) (DBH at 1.35 m) and diameter root collar (cm) (if height was <1.35 m: in particular for so called Bonsai-shaped trees). Parameters collected of seedlings (trees <1.35 m in height) included: age class (yrs), number of individuals per species per age class, and mean height per cohort (m).

Plot size & coordinates

The plot size used for the phytosociological relevé was 20×20 m². Because of time limitations, the size of the forest ecological plot within the phytosociological plot was 10×10 m². The plot was laid out and controlled by measuring by foot, with an accuracy of 0.5 m, after which corners were temporarily marked. Based on field characteristics, plots were marked on printed satellite images as good as possible.

Representativeness

Care was taken that the forest plots and relevés were representative for the encountered local situation (trees, forest floor). The locations of the forest ecological plots depended on the choice for the phytosociological relevés, which was based on the forest type. The leading principle was to assure a representative assessment of all distinguishable units on the false colour satellite image prints. Within the phytosociological relevé, the choice of the forest ecological plot was based on the representativeness of the tree layer. It was not possible to distribute the sampling of the forest plots over *ca.* 10 forest types with 3-10 plots/type.

Measurements

Tree diameters were measured with an accuracy of 0.1 mm. Height and crown base of trees were estimated by the skilled forestry fieldworkers Slim and Degteva with an accuracy of *ca.* 0.1 m in the lower region and of *ca.* 1 m in the higher ones. In every plot estimates were calibrated with a Carl Zeiss tree measurement device. The height of seedlings was measured with an accuracy of *ca.* 0.01 m in the lower regions and of *ca.* 0.1 in the higher ones. Age of trees and seedlings was estimated by Slim and Degteva, often calibrated by counting the every year growth marks, or counting tree-rings destructively (seedlings). In every plot some mature trees were cored by an increment borer (drilling equipment), and tree-rings could be counted in the field with a lens (loupe) to calibrate the estimations of tree age. Counting was not easy due to the insects, light conditions, rottened heart of the tree, and handling the core under difficult terrain circumstances. Tree-rings of coniferous tree species were easy to count, but especially *Betula* and *Populus* species appeared to be difficult or impossible to count (Schweingruber 1989). More information about age in relation to height and diameter has to be derived from relevant tables in Russian literature.

Nomenclature of trees was copied from a special phytosociological database, resembling the opinion of Russian taxonomists. Sometimes the difference between the tree species *Betula pubescens* and *B. pendula* was difficult, but based on the experience and best professional judgement, a choice always could be

made. The shrub species *Juniperus communis* L. is not measured or counted because this species will never grow out as a (little) tree.

Data were collected in a logbook, and afterwards put in a FORGRA format database; partly in the field on a laptop, and partly in the institute. There was not yet time for a rigid control of the input.

Preliminary results

The main tree species encountered in the forest plots included *Pinus sylvestris* L., *P. sibirica* Du Tour, *Picea obovata* Ledeb., *Larix sibirica* Ledeb., *Abies sibirica* Ledeb., *Betula pendula* Roth, *B. pubescens* Ehrh., *B. tortuosa* Ledeb., *Populus tremula* L., *Sorbus aucuparia* L., *Padus avium* Mill., *Salix caprea* L., *S. myrsinifolia* Salisb., *S. phylicifolia* L., *S. dasyclados* Wimm. and *Duschekia fruticosa* (Rupr.) Pouzar.

In 57 forest ecological plots of 100 m² each, a total of 2,059 trees (36 individuals/plot) and 3,157 seedlings (sometimes suckers) were measured (67 individuals/plot). Currently data analysis is in progress. Table 2.1.3.1 shows a detailed example of data collected at two forest ecological plots, while table 2.1.3.2 shows an overview of the collected data according to forest type, forest management (clear cut, selective cutting, coulisse cutting, not harvested/not managed), other disturbances (fire, storm, grazing).

Table 2.1.3.1 Example of two different forest ecological plots (100 m²): Birch forest (clear-cut, original Spruce forest) and Pine forest (pristine, evidence of fire).

Species	Birch forest, haircap moss type, upland area (running number 2003121)				Pine forest, greenmoss type, floodplain area (running number 2003226)			
	Trees (n)	Average height (m)	Average DBH (cm)	Seedlings (n)	Trees (n)	Average height (m)	Average DBH (cm)	Seedlings (n)
Betula pubescens	136	2.23	1.06	12	1	5.00	4.90	
Picea obovata	5	1.96	1.54	7	45	2.73	2.72	48
Pinus sylvestris	3	1.83	1.60	1	2	26.50	43.90	
Betula pendula					18	6.24	3.96	1
Abies sibirica					7	1.98	1.60	9
Sorbus aucuparia					1	1.60	0.30	

Typical clear-cutting in the Pechora basin

Coulisse cutting

Table 2.1.3.2 Preliminary overview of forest ecological plots sampled in different landscape and forest types, and in different forest management types.

Landscape classification			Forest management type			Natural disturbance (fire, storm, grazing)
Landscape type	**Forest unit**	**Forest type**	**Clear-cut**	**Selective cutting**	**No use**	
Upland area (Watershed)	Spruce forest	Spruce, Greenmoss type		3	3	
		Spruce, Haircap moss type				
		Spruce, Sphagnum type			2	
		Spruce, Herb type			2	
		Spruce, Tall herb type			1	
	Pine forest	Pine, Lichen type	2	1	2	
		Spruce, Haircap moss type	1			1
		Pine, Sphagnum type			2	1
	Aspen forest	Aspen, Greenmoss type	2			1
		Spruce, Haircap moss type	1			
		Aspen, Herb type				1
	Birch forest	Birch, Greenmoss type		1		
		Spruce, Haircap moss type	1			2
		Birch, Sphagnum type	1			
		Birch, Herb type				1
	Mixed Spruce, Pine, Fir, Birch	mixed, Greenmoss type		2	3	2
		mixed, Greenmoss type, mountain			1	
		Spruce, Haircap moss type				
		mixed, Sphagnum type	1			
		mixed, Herb type			5	
		mixed, Tall herb type		1	2	
	Shrub vegetation, Fir, Aspen	mountain tundra			1	
Floodplain area	Mixed forest		1			
	Spruce forest			1		
	Aspen forest					
	Willow forest	willow, Tall herb type			2	
	Pine forest	Pine, Greenmoss type			1	
	Birch forest	Birch, Herb type			2	
	Spruce forest	Spruce, Greenmoss type		3	3	

Recommendations

In future, phytosociological and forest ecological data should be collected in a better stratified way with a rigorous protocol, based on Land Units obtained by satellite image classification (Van der Sluis & Den Hollander 2002). This stratification could include detailed Russian forestry maps, as most forestry units on the forestry maps could be distinguished on the satellite images. Standard forms need to be developed, and more eye-catching corner markers taken. For monitoring circular plots should be considered.

References

1. Jorritsma I.T.M., Hees A.F.M. van & Mohren G.M.J., 1999. Forest development in relation to ungulate grazing: a modelling approach. Forestry Ecology and Management No. 120, p. 23-34;
2. Sluis T. van der & Hollander H. den, 2002. Land Units at different scales. In: Leummens H., Ponomarev V. & Sluis T. van der (Eds.). Pechora Ecosystems; Research and Basin wide Management Programme. IB-KSC/RWS-RIZA/ALTERRA/LNV/ RWS-MD/DHV, Moscow/Syktyvkar, 122 pp.;
3. Schweingruber F.H., 1989. Tree Rings – Basics and Applications of Dendrochronology. Kluwer, Dordrecht. 276 pp.