Species composition of flora on abandoned farmlands in Tver region

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Abstract. The object of the research is the deserted agricultural territories of various ages, located in the territory of Tver’ region. New growth is mainly represented by birch, asp and pine totalling up to 2867 pcs./hectare. There are goat willow and roan-tree in the understory, totalling 33 to 2566 pcs./hectare. It is ascertained that forest live cover of deserted agricultural lands consists of 63 species of higher plants, mostly grass plants. The number of species which belong to various topographic features is 25-32 species. In the beginning years growing associations change dynamically. The floristic composition of the plant formation is being stabilized in 15-20 years.

1. Introduction

The problem of colonization of former farmlands by trees is actual for Russia until the present days. According to the information of the Ministry of Agriculture, more than 40 million hectares of deserted farm fields, haylands and laylands require re-cultivation procedures [1-6]. The forest live cover, in particular grassy, plays a significant role of forest’s bios [7-9]. The stable ground vegetation usually represented by shade-resistance species, is being appeared in 15-20 years. As a rule, a pattern of plant formation being formed is the cereal birch forest. However, the cereal birch forest is not stable enough and is subject to change to a main type of the forest matching the given conditions, in a time [2, 10].

Goal of the research is to assess the species diversity of the flora on farmlands deserted in various times.

2. Methods and Materials

Object of the research is the deserted farmlands of various ages located in the territory of Tver’ region. The geography is hilly. At farmlands, there are presently trees, which have been planted or volunteer planted in the time of purposed usage of the lands (forest shelter belt, ordinary filling-ups along roads and ameliorative ditches, scattered trees near fields’ borders). The age of such trees is about 45-65 years for broadleaved species and about 100 years for pines. The trees along roads have been used as snow capturing, and those have been planted in 1963-1964. Before the trees were planted along roads, snow-retaining hovels had been mounted.

Each of three hills was examined in 4 directions – the Northern, the Southern, the Western and the Eastern brae, as well as hill’s peak, the discount areas being prepared down the hill, according to
reputed methodology [11, 12]. The recording and visual assessment of the natural renewal have been made along computation routes, regularly placed on each object. In order to record young growth and low cover flora, some round discount areas with the radius of 178.5 cm have been established. The condition of the young growth, their number, occurrence and altitude structure have been registered. At round areas, the forest understory (the structure, the number and the altitude structure) and the forest live cover (the floristic composition, the projective cover and the occurrence, by species) have been recorded as well.

3. Results and Discussion
The investigation of hills downwards four directions reveals that within growing stocks the birch is prevailing in hill’s peaks and in Western and Eastern braes (table 1).

Table 1. Specifics of the objects of the research.

| Object number | Object location | Territories deserted since | Structure of forest cover, % | Approximate age of trees, years | Total number of trees, pcs./hectare |
|---------------|-----------------|---------------------------|-----------------------------|---------------------------------|-------------------------------------|
| 1.            | Western brae    | 1998                      | 7Birch 1Pine 2Alder         | 65                              | 42                                  |
| 2.            | Eastern brae    | 1998                      | 5Birch 1Pine                | 65                              | 26                                  |
| 3.            | Northern brae   | 1998                      | 9Alder 1Birch               | 45                              | 24                                  |
| 4.            | Southern brae   | 2000                      | Timber species are not being renewed |                          |                                     |
| 5.            | Eastern brae    | 1997                      | 5Birch 5Aspen               | 60                              | 33                                  |
| 6.            | Southern brae   | 1994                      | 9Birch 1Aspen+ Spruce       | 65                              | 20                                  |
| 7.            | Western brae    | 1997                      | 9Birch 1Aspen+ Pine         | 60                              | 36                                  |
| 8.            | Northern brae   | 1997                      | 6Birch 4Aspen+ Alder        | 55                              | 30                                  |
| 9.            | Eastern brae    | 1998                      | 7Birch 2Aspen 1Alder        | 50                              | 39                                  |
| 10.           | Northern brae   | 1998                      | 5Aspen 3Birch 2Alder        | 50                              | 67                                  |
| 11.           | Western brae    | 1990                      | 10Birch+Alder               | 60                              | 32                                  |
| 12.           | Southern brae   | 1998                      | 5Birch 1Aspen 4Alder        | 55                              | 67                                  |
| 13.           | Eastern brae    | 1996                      | 5Birch 4Aspen 1Pine         | 55                              | 36                                  |

There are big trees amounting 20 to 70 pcs/hectare at former fields, haylands and laylands. These trees of deserted lands participate in forming of leafy young trees, amounting to 3 thousands/hectare (through seed and vegetative reafforestation). Most often, ligneous plants occurred in forest communities being formed are all the same: birch, asp, and alder. All objects have birches. Pines and firs are less often and of a little amount, see table 1.

In the course of the research, it was revealed that the number of young generation of forest forming species at deserted farm lands varies 240 to 5907 pcs/hectare, depending on forest growth conditions and age of alteration of lands’ status.

The table shows that the structure, the number and other characteristics of new growth of ligneous plants significantly vary one object of the research to another. This is caused by different age of alteration of lands’ status and different conditions of the site.

In the course of the research, it was revealed that the process of regeneration at braes goes mostly with the help of the silver birch. There are asps, pines and firs prevailing on objects 9, 11 and 12 within the forming plant formations. Depending of the age of deserted fields, pines and firs quite often
appear within young growth (objects 1 and 2, 3, 11, 12, 13). Tables 1 and 2 show that grey alder and asp prevail at Northern and Eastern braes of hills.

**Table 2.** Structure and number of new growth.

| No  | Braedisplayed     | Number, pcs./hectare | Structure                                      |
|-----|-------------------|-----------------------|------------------------------------------------|
| 1   | Westernbrae       | 600                   | 9SilverBirch 1Pine                             |
| 2   | Easternbrae       | 667                   | 4Silver Birch 3Pine 3Aspen                     |
| 3   | Northernbrae      | 240                   | 7SilverBirch 3Pine                             |
| 4   | Southernbrae      | Timber species are not being renewed |                                                 |
| 5   | Easternbrae       | 633                   | 5Silver birch 5Aspen                           |
| 6   | Southernbrae      | 700                   | 7Silver birch 1Aspen 2White birch +Petiolate oak |
| 7   | Westernbrae       | 1800                  | 9Silver birch 1Aspen+Spruce                    |
| 8   | Northernbrae      | 900                   | 6Silver birch 4Aspen                           |
| 9   | Easternbrae       | 1900                  | 6Aspen 4Silver birch+Pine                     |
| 10  | Northernbrae      | 2867                  | 8Silver birch 2Aspen + Pine                   |
| 11  | Westernbrae       | 732                   | 7Spruce 2Aspen 1Silver birch                  |
| 12  | Southernbrae      | 267                   | 6Pine 4Silver birch                            |
| 13  | Easternbrae       | 5907                  | 7White birch 2 Silver birch 1Grey alder+ Aspen + Spruce + Pine |

There are goat willow and roan-tree in the understory, totalling 33 to 2566 pcs/hectare. The only forest understory of the object 2 is completely presented by apples, whereas apples prevail on the object 3. Occasionally, there are bird-cherrys appeared at deserted lands.

The floristic composition, the number of young growth and understory depend on the type it has been used in the past (layland, hayland, farm field) and on ground’s characteristics.

There are 63 species of higher plants and some species of green mosses in the forest live cover. The recording works, from object to object, revealed 19 to 32 species, table 3.

**Table 3.** Structure of forest live cover.

| Object No. | Number of species | Projective cover, % | Number of species, by groups |
|------------|-------------------|---------------------|-----------------------------|
|            |                   |                     | Grain varieties legumes Short grasses others |
| 1          | 19                | 123                 | 2 2 14 1                    |
| 2          | 21                | 116                 | 3 2 13 2                    |
| 3          | 24                | 108                 | 3 2 17 2                    |
| 4          | 26                | 98                  | 3 1 20 2                    |
| 5          | 28                | 90                  | 3 2 20 3                    |
| 7          | 28                | 102                 | 4 3 17 4                    |
| 8          | 26                | 101                 | 3 3 17 3                    |
| 9          | 26                | 120                 | 3 2 17 4                    |
| 10         | 25                | 113                 | 2 2 19 3                    |
| 11         | 19                | 39                  | 2 0 13 4                    |
| 12         | 25                | 119                 | 2 2 18 3                    |
| 13         | 32                | 129                 | 1 2 20 9                    |

On Southern and Western braes, the cereals, the firetop and the cow clover dominate; on Northern and Eastern braes the wild angelica, the blue cow wheat, the orchard grass and the bottle brush dominate.
The general trend is that the plant formation consists mostly of grass plants, the cow clover, the goatweed, the goldenrod, and the bottle brush, table. 4

**Table 4.** The floristic composition of dominants on the objects of the research (occurrence above 50%).

| No. | Species                              | Species occurrence, % |
|-----|--------------------------------------|-----------------------|
| 1   | Brown knapweed (*Centaurea jacea* L.) | 83.3                  |
| 2   | Wild angelica (*Angelica sylvestris* L.) | 66.7                  |
| 3   | Orchard grass (*Dactylis glomerata* L.) | 91.7                  |
| 4   | Goatweed (*Hypericum perforatum* L.)  | 100                   |
| 5   | Wild strawberry (*Fragaria vesca* L.)  | 58.3                  |
| 6   | European goldenrod (*Solidago virgarea* L.) | 91.7                  |
| 7   | Blue cowwheat (*Melampyrum nemorosum* L.) | 58.3                  |
| 8   | Firetop (*Chamaenerion angustifolium* L.) | 83.3                  |
| 9   | Cow clover (*Trifolium pratense* L.)   | 91.7                  |
| 10  | Thistle (*Cirsium arvense* Scop.)      | 75.0                  |
| 11  | Tormentil (*Potentilla erecta* L. Rauusch.) | 75.0                  |
| 12  | Mock gilled (*Saponaria officinalis* L.) | 58.3                  |
| 13  | Fleawort (*Galium verum* L.)           | 75.0                  |
| 14  | Absinth (*Artemisia absinthium* L.)    | 83.3                  |
| 15  | Old-man's-pepper (*Achillea millefolium* L.) | 75.0                  |
| 16  | Toadpipe (*Equisetum arvense* L.)     | 100                   |

The general projective cover of the dominant species is above 50%. The occurrence of these species at the objects of the research reaches 100%. At the given development phase of forest communities within forest live cover, forest species do not exceed 10% of all number of species recorded.

4. Conclusions
The conducted study allows making the following conclusions:

1. Forest species occupying lands out of agricultural use are birches, asps and alders. In solitary instances, the conifers (pines and firs) may appear. The total number of forest-forming species reaches 2.9 thousands/hectare.
2. There are 4 species in understory of deserted lands of agricultural purpose. The number of understory at objects of the investigation varies 33 to 2566 pcs./hectare, with subsequent accounting, the amount of undergrowth was reduced to 637 copies/ha.
3. There are 63 species of higher plants and some species of green mosses in the forest live cover.
4. At the first development phase of forest communities within forest live cover (15-20 years), forest species do not exceed 10% of all number of species recorded.
5. The plant formation consists mostly of grass plants, the cow clover, the goatweed, the goldenrod, and the bottle brush.

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