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FORMATION AND DEGRADATION OF UPLAND MEADOWS UNDER THE INFLUENCE OF HAYING AND GRAZING

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This article characterizes general patterns of anthropogenic transformation of upland meadows of postforest origin in the boreal-forest zone. Changes in the floristic composition, structure, and productivity of meadow communities are evaluated using the criterion of the level of their synanthropization.

In the boreal-forest zone, tracts of upland meadows arose on the site of cleared forests. In the course of economic appropriation of forest territories, the local residents usually used small forest glades in places with a thinned forest canopy and well developed herbaceous cover for haying, and then expanded their area. In many cases, fairly productive haylands that existed for a long time were formed on such glades, but after the transition to immoderate pasture use degradation of them occurred.

The change in meadow communities under the influence of hay and pasture use is a particular case of a more general process of synanthropization of the plant cover (Gorchakovskii, 1979; Falinski, 1972; Kostrowicki, 1982).

The present work gives results of study of the patterns of formation and degradation of postforest upland meadows on low and middle levels of the west slope of the Central Urals, in the basin of the Chusovaya River. Meadows were formed in this part of the Urals back in the last century, and in some cases even earlier, on the site of former pine forests. Meadow glades with an area from 0.2 to 3-5 ha are surrounded by forest up to the present time. In the region of the investigation, meadows that emerged from the forest rather long ago (from 50 to 200 years) are found, as well as meadow communities that arose comparatively recently, the flora of which still preserves a forest appearance to a significant extent. Prolonged use of such meadows as hay fields, and near populated points as pastures as well, has led to significant changes in their composition, structure, and productivity: meadow communities subjected to various degrees of synanthropization can be found here, depending on the nature, duration, and intensity of their use.

In connection with the need to organize ecological monitoring of fodder lands (Gorchakovskii, 1984: Gorchakovskii and Abramchuk, 1984) and substantiate measures to restore their potential productivity, it is very important to develop a procedure for evaluating the level of synanthropization of meadow communities. In our previous works (Abramchuk and Gorchakovskii, 1980; Gorchakovskii and Abramchuk, 1983), we substantiated the possibility of evaluating the degree of anthropogenic degradation of meadows according to the portion of participation of synanthropic species in their composition (in percent of the total species composition and according to their contribution to formation of the aboveground phytomass). These criteria were used in the present work to reveal the degree of anthropogenic transformation of upland meadows of the Central Urals.

PROCEDURE OF INVESTIGATIONS

To characterize meadow vegetation, sample areas 10 × 10 m in size were laid out so that there were no fewer than 10 descriptions (80 descriptions were made in all) for each model community (1a, 1b, etc.). On the sample areas, we studied the morphological structure of soils and took soil specimens for mechanical and chemical analysis. The density (hardness) of the soil was determined with I. F. Golubev's densimeter. The herbage was described by sublayers, if they were expressed.

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TABLE 1. Changes in Meadow Vegetation in the Course of Synanthropization

Level of synanthropization	Community	Soil	Herbage				Including synanthropic ones
			Basic components	Coverage % / Sodded area	Number of species / Moss cover	% of synanthropic species	
1	2	3	4	5	6	7	8
1a	Globeflower-syndow	Sod–heavily podzolic, medium- or heavy-loamy	cop.$_2$ — *Alchemilla murbeckiana*, cop.$_{1-2}$ — *Trollius europaeus*, cop.$_1$ — *Cirsium heterophyllum*, sp.— cop.$_1$ — Geranium sylvaticum	85—90 / 10—15	63 / 7	11,1	*Pleurozium schreberi, Rhytidiadelphus triquetrus, Hylocomium splendens* (coverage 30-40%)
1b	Globeflower-thistle	Sod–medium-podzolic gleyic, medium-loamy	cop.$_2$ — *Cirsium heterophyllum*, cop.$_1$ — *Trollius europaeus*, sp.— cop.$_1$ — *Aegopodium podagraria, Alchemillu murbeckiana, Geranium sylvaticum*	85—95 / 10—15	73 / 6	8,2	*Pleurozium schreberi, Hylocomium splendens*, admixture of *Aulacomnium palustre, Mnium drummondii* (coverage 30-50%)
1c	Geranium-aegopodium	Sod–medium-podzolic gleyic, medium-loamy	cop.$_2$ — *Aegopodium podagraria*, cop.$_{1-2}$ — *Geranium sylvaticum*, cop.$_1$ — *Alchemilla murbeckiana*, sp.— cop.$_1$ — *Cirsium heterophyllum*, sp.— *Heracleum sibiricum*	80—85 / 8—10	67 / 6	8,9	*Brachythecium mildeanum*, admixture of *Pleurozium schreberi, Rhytidiadelphus calvescens, Dicranum bonjeani* (coverage 30-50%)

TABLE 1. (Continued)

1	2	3	4	5	6	7	8
IIa	Meadow-fescue–syndow	Sod-humus gleyic, medium-loamy	cop.$_2$ — *Alchemilla murbeckiana*, cop.$_{1-2}$ — *Festuca pratensis*, sp.— cop.$_1$ — *Phleum pratense, Agrostis tenuis*	85—95 / 20—25	65 / 10	15,4	*Thuidium abietinum, Climacium dendroides* (coverage 20-30%)
IIb	Syndow–meadow-fescue	Sod-humus gleyic, medium- or heavy-loamy	cop.$_2$ — *Festuca pratensis*, cop.$_1$ — *Alchemilla murbeckiana*, sp.— cop.$_1$ — *Phleum pratense, Dactylis glomerata, Agrostis gigantea*	90—95 / 20—25	53 / 11	21,1	Sparse *Thuidium abietinum, Clematum dendroides* (coverage 10%)
IIIa	Syndow-caraway	Sod-humus gleyic, medium- and light-loamy	cop.$_2$ — *Carum carvi*, cop.$_1$ — *Alchemilla tubulosa*, sp.— cop.$_1$ — *Festuca pratensis, Poa pratensis, Achillea millefolium, Plantago media*	80—85 / 20	38 / 11	30,0	Very sparse *Thuidium abietinum, Climacium dendroides* (coverage 5%)
IIIb	Bluegrass–white-clover	Sod-humus gleyic degraded, medium- and heavy-loamy	cop.$_2$ — *Trifolium repens*, cop.$_1$ — *Poa pratensis*, sp.— cop.$_1$ — *Plantago major*, sp.— *P. media, Achillea millefolium, Leontodon autumnalis*	85—90 / 25—30	24 / 13	54,1	Absent
IV	Knotweed	Sod-humus gleyic, heavily degraded, medium- and heavy-loamy	cop.$_2$ — *Polygonum aviculare*, sol.— sp.— *Plantago media, P. major, Taraxacum officinale*	45—50 / 5	9 / 9	100	Absent

We indicated the complete species composition and noted the abundance on the Drude scale, the height of the plants and their vitality, the ratio of ecobiomorphs, and the presence of synanthropic species.

The biological productivity of meadow communities was evaluated in indices of the store of aboveground and underground phytomass. Aboveground phytomass was recorded and its vertical structure was determined on 0.5 × 1.0 m plots in four-fold replication (Rabotnov, 1961, 1966). During the period of mass flowering of most of the plants, the herbage was cut off at the level of the soil surface. The cut herbs were immediately sorted by agrobotanical groups: grasses, legumes, and forbs. Within each group, we separated dominants, codominants, and synanthropic species. The phytomass was dried to an air-dry state and weighed. To determine the store of underground phytomass, with a steel auger (80 mm in diameter) with a cross-sectional area of 50 cm^2 we took specimens by layers (0-5, 5-10 cm, etc.), in six-fold replication. The plants' underground organs were washed off in running river water. The washed-off phytomass was dried to an air-dry state and weighed.

LEVELS OF SYNANTHROPIZATION OF UPLAND MEADOWS

On the basis of results of the investigation that was performed, taking into account previously conducted works, we can distinguish four levels of synanthropization of upland meadows.

I. Meadows formed comparatively recently on the site of former forests. They still contain many forest species, and a fairly thick moss cover is developed on the soil surface. The herbage is relatively rich in floristic composition; forbs are absolutely dominant in it; the admixture of grasses is insignificant. The index of synanthropization is up to 15% by species composition, and up to 5% by the portion in the composition of aboveground phytomass.

II. Meadows that have experienced longer hay use. The herbage is somewhat poorer in floristic composition on account of the loss of part of the forest species. The leading role switches to high and semihigh grasses; forbs fade into the background. The moss cover decreases. The index of synanthropization is from 16 to 25% by species composition, and 6-15% by phytomass.

III. Meadows subjected to intensive grazing. The transition from hay use to pasture use is accompanied by significant impoverishment of the herbage's species composition. The position of grasses weakens, with a simultaneous replacement of high and semihigh grasses by short ones. Mosses disappear completely. The index of synanthropization is 26-60% by species composition, and 16-65% by phytomass.

IV. Heavily disturbed communities with extremely impoverished species composition, completely composed of synanthropic, primarily annual species. The index of synanthropization is from 61 to 100% by species composition, and from 66 to 100% by phytomass.

The objects of the investigation were eight most typical meadow communities at different levels of synanthropization: three communities at the first level, two at the second, two at the third, and one at the fourth level. The decrease in number of communities with a rise in the level of their synanthropization is the result of convergence. The basic traits of the communities that were studied are given in Table 1. Auxiliary indices within the levels of synanthropization (a, b, c) have only arbitrary significance for identification.

CHANGES IN STRUCTURE AND COMPOSITION OF MEADOW COMMUNITIES

On the whole, meadows at the **first level of synanthropization** are characterized by low sward density and slight sodded area. The density (hardness) of the soil is not high: 7-9 kg/cm^2. This results in a predominance of short- and long-rhizome perennial herbs, which require good aeration of the soil. Their participation in the composition of the phytomass reaches 53-61% in different variants. The set of cenotic groups in the herbage is diverse. Approximately a third (29-37%) is made up of typically forest species: *Lathyrus gmelinii, L. vernus, Melica nutans, Angelica sylvestris, Asarum europaeum, Aconitum septentrionale, Bupleurium aureum*, etc.; there is a significant admixture of meadow-forest species (18-24%): *Campanula patula, Cirsium heterophyllum, Geranium sylvaticum, Veratrum lobelianum*, etc.; and the presence of bog-meadow species is noted (6-11%): *Myosotis caespitosa, Peucedanum palustre, Polygonum bistorta*, etc. The participation of meadow species proper varies from 27 to 40%.

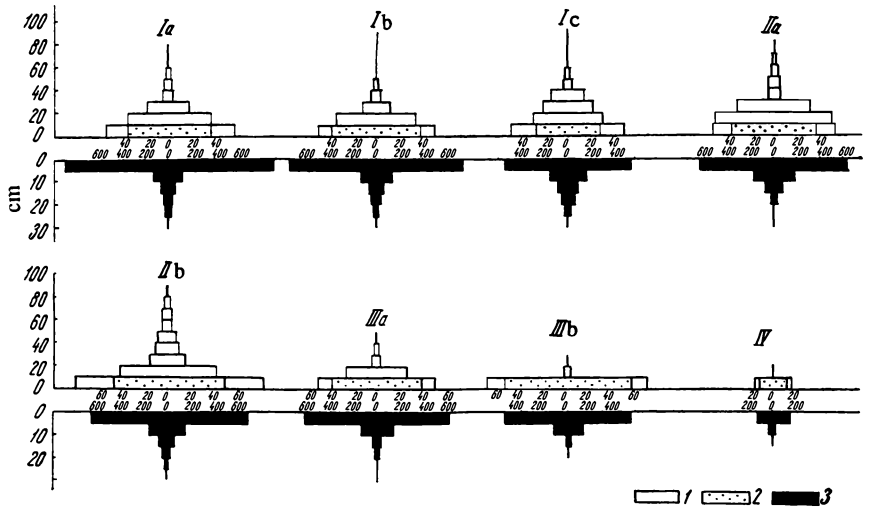

Fig. 1. Layer-by-layer distribution (stratification) of phytomass in meadow communities at different levels of synanthropization (I-IV): Phytomass, g/m^2: 1) aboveground; 2) the part of aboveground phytomass below the level of mowing (7 cm); 3) underground.

Among the ecological groups, mesophytes predominate (68-76%), with fairly significant participation of relatively hygrophilous plants: hygromesophytes (14-18%) *Aegopodium podagraria, Ajuga reptans, Stachys sylvatica, Succisa pratensis*, etc., and mesohygrophytes (5-8%) *Ranunculus monophyllus, Coronaria flos-cuculi, Geum rivale, Filipendula ulmaria*. The herbage is mostly (92-97%) formed by perennial herbs; the admixture of annuals and biennials is not significant (3-8%). The dominant role belongs to forbs (49-53 species); the participation of legume and grasses is slight (6-10 species).

The composition of the flora reflects peculiarities of such meadows' origin: in their herbage there are still many typically forest species, and the presence of meadow-forest and bog-meadow species is characteristic. These meadows are distinguished by fairly great floristic wealth: the number of species in different variants of the communities is from 63 to 73; of these, only 6-7 are synanthropic.

At the **second level of synanthropization**, the soil density is higher (10-12 kg/cm^2). Short- and long-rhizome perennials still predominate in the spectrum of ecobiomorphs (47-59%), although the presence of rhizome–loose-sod and loose-sod perennials is noticeable (9-11%). In their ratio of ecological groups, such meadows are still fairly similar to communities at the first level of synanthropization: mesophytes 81-82%, hygromesophytes 9-12%, mesohygrophytes 6%, xeromesophytes 4%, but in the spectrum of cenotic groups the portion of meadow plants proper increases (42-57%). This occurs on account of the loss of certain forest species (*Melica nutans, Anthriscus sylvestris, Angelica sylvestris, Pulmonaria obscura*). However, the participation of the forest species that are left — *Aegopodium podagraria, Ajuga reptans, Betonica officinalis, Crepis sibirica, Hieracium umbellatum*, etc. (13-28%) — and also of meadow-forest species — *Alchemilla murbeckiana, Cerastium holosteoides, Cirsium heterophyllum, Galium erectum* (17-21%) — is still fairly great. Tall herbs cede their leading position to grasses *Festuca pratensis, Dactylis glomerata, Phleum pratense*, and *Agrostis tenuis*. In connection with this, the degree of sodding rises, and the herbage's projective coverage remains high. Previously absent synanthropic plants appear: *Leontodon autumnalis, Potentilla anserina*, and *Alchemilla tubulosa*. The herbage is mostly (94-95%) formed by perennial herbs; the role of annuals and biennials is not great. The overall floristic wealth is lower in comparison with the preceding level: from 53 to 65 species in different communities. The reduction in numbers of forest species is partially compensated by the introduction of synanthropic ones (10-11).

At the **third level of synanthropization**, hay use is replaced by pasture use. The soil is compacted (density 19-25 kg/cm^2). Under the influence of grazing, the position of short- and long-rhizome perennials is somewhat weakened in the composition of ecobiomorphs (34-40%), but the role of rhizome–loose-sod, and loose- and dense-sod perennials increases. The portion of forest (4-8%), meadow-forest (4-16%), and bog-meadow (0-2%) species decreases sharply. *Lathyrus vernus, Aegopodium podagraria, Ajuga reptans, Betonica officinalis, Botrychium lunaria*, and *Crepis sibirica* drop out of the number of forest species; and *Coronaria flos-cuculi, Geum rivale, Polygonum bistorta*, and *Potentilla erecta*, from the bog-meadow ones.

TABLE 2. Productivity of Meadow Communities at Different Levels of Synanthropization (I-IV)

Phytomass, g/m^2	I	II	III	IV
Aboveground	188—247	311—347	143—176	34
Including live (biomass)	173—213	295—321	134—164	30
Dead attached	15—34	16—26	9—12	4
Underground	1600—2143	1798—1800	1340—1603	281
Total store	1788—2390	2109—2147	1483—1779	315
Ratio of aboveground to underground	1:8,5—1:8,6	1:5,8—1:5,2	1:9,4—1:9,1	1:8,3
Aboveground phytomass of synanthropic species	7—9	16—36	91—98	34
Portion of synanthropic species in composition of aboveground phytomass, %	3,7—3,6	5,1—10,4	63,6—55,7	100

However, the former connection of such meadows with communities of postforest origin is indicated by the presence of certain forest (*Vicia sepium, Viola canina, Veronica chamaedrys*) and meadow-forest (*Alchemilla murbeckiana, Campanula patula, Galium mollugo, Ranunculus auricomus, Heracleum sibiricum, Stellaria graminea*) species that have displayed greater tolerance. The introduction and intensification of the position of weed plants is typical: *Matricaria inodora, Polygonum aviculare, Taraxacum officinale*). Meadow plants proper are predominant in the herbage (66-71%). New forest-steppe species are not introduced, but the portion of their participation rises somewhat (5-8%) in connection with a reduction in the overall species wealth.

In the ecological spectrum, mesophytes (87%) predominate; xeromesophytes amount to 5-8%; and the participation of mesohygrophytes and hygromesophytes does not exceed 3-5%. The ratio of ecobiomorphs also changes: the percent of long- and short-rhizome plants decreases; species with creeping, rooting, aboveground shoots acquire a predominant position: *Trifolium repens* and *Potentilla anserina*; as before, perennial herbs form the greater part of the herbage (88-95%), and annuals and biennials account for 5-12%. The floristic composition is even more simplified; it numbers only 24-38 species. The number of synanthropic species rises somewhat (11-13).

At the **fourth level of synanthropization**, under the influence of long and very intensive pasture loads, the soil density rises to 28-30 kg/cm^2. Two cenotic groups participate in the herbage's composition: meadow (44%) and weed (56%) species. Perennial grasses are completely lost; they are replaced by the loose-sod annual and biennial *Poa annua*. Together with annual forbs (*Polygonum aviculare, Matricaria inodora, Capsella bursa-pastoris*), annual and biennials account for 33% of the species composition. Perennial forbs are represented by rosette species (44%) — *Taraxacum officinale, Leontodon autumnalis, Plantago media, P. major* — and an aboveground-rooting species (11%) — *Potentilla anserina*. The dominant species are those in which the greater part of the phytomass is located in the horizon near the ground and therefore is better preserved during grazing. Knotweed, or way-grass *Polygonum aviculare*, reaches the greatest development; as a rule, its appearance is preceded by strong compaction of the soil.

The pasture tolerance of knotweed is due to its high seed productivity, good aftermath ability, and ability to form branched shoots creeping over the soil surface, as a consequence of which the plants are less damaged by livestock. The ecological spectrum is represented by just one group: mesophytes (100%). Nine species take part in the herbage's composition, and all of them are classified as synanthropic.

CHANGES IN PRODUCTIVITY

In communities belonging to the **first level of synanthropization**, the total store of phytomass of vascular plants varies from 1788 to 2390 g/m^2, including 188-247 g/m^2 of aboveground phytomass and 1600-2143 g/m^2 of underground phytomass. The ratio of aboveground phytomass to underground is 1:8.5-1:8.6 in different communities (Table 2). The aboveground phytomass (Fig. 1) is concentrated mostly in the lower horizons, with from a fourth to a third of it being located in the layer below the level of mowing (0-7 cm).

Forbs predominate in the herbage's composition (Fig. 2). The main production is formed by dominant and codominant species: *Alchemilla murbeckiana, Aegopodium podagraria, Cirsium heterophyllum, Geranium sylvaticum, Tollius europaeus*. The mass of legumes is negligible. The store of grasses' phytomass is not great. The mass of synanthropic species is also insignificant. The moss cover is well developed; it accounts for from 99.0 to 163.3 g/m^2.

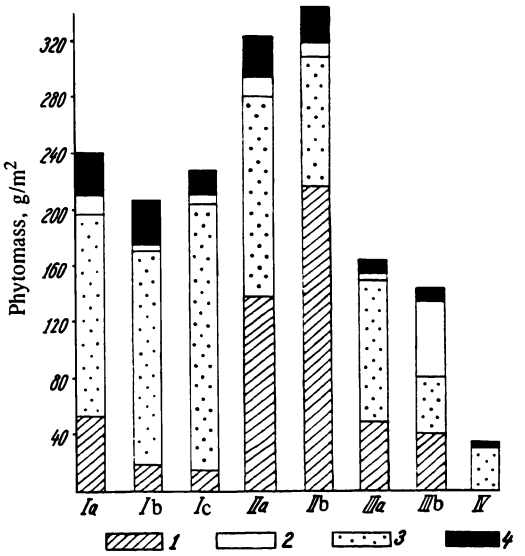

Fig. 2. Ratio of agrobotanical groups (1-4) in meadow communities at different levels of synanthropization (I-IV): 1) grasses; 2) legumes; 3) forbs; 4) dead attached phytomass.

The greater part of the underground phytomass is in the 0-5 cm horizon. The surface localization of root systems is apparently explained by a number of factors: higher fertility of the upper horizon (Shalyt, 1950), better aeration, and a lower content of carbon dioxide in upper layers (Klapp, 1961; Rabotnov, 1974).

The herbage's fodder merits are low, due to the presence of poisonous herbs: *Trollius europaeus, Veratrum lobelianum*, species of the *Ranunculus* and *Hypericum* genera, and also species of little fodder value and slightly edible ones: *Aegopodium podagraria, Cirsium heterophyllum, Alchemilla murbeckiana*, etc.

At the **second level of synanthropization**, the store of aboveground phytomass rises somewhat (311-347 g/m^2), and the total store of phytomass is 2109-2174 g/m^2; the ratio of aboveground mass to underground is 1:5.2-1:5.8. In the distribution of aboveground phytomass, a reduction is noted in its content in the 0-7 cm horizon, and it is more evenly distributed vertically. The greater part of the underground phytomass is concentrated in the 0-5 cm horizon, and only 1.1-1.7% is located in the 25-30 cm layer.

Under the influence of prolonged haying, tall herbs are replaced in the herbage by grasses that possess good aftermath ability. Of these, meadow fescue *Festuca pratensis* begins to predominate — a species that is very flexible, with a wide ecological range. Timothy grass *Phleum pratense* and cock's-foot grass *Dactylis glomerata* only form an admixture, which is explained by the soil's insufficient provision with nutrients. On the whole, grasses form about half of all the aboveground phytomass, and forbs amount to more than a third. The mass of legumes is insignificant. At this level, the mass of synanthropic species rises noticeably. A dense, tall sward forms, in connection with which the mass of mosses is sharply reduced (49.4-97.6 g/m^2).

The herbage's fodder merits are high, which is determined by the presence of such valuable fodder grasses as meadow fescue, timothy grass, cock's-foot grass, etc. These are the most productive and economically valuable meadows. The main species of herbs are distinguished by high nutritive value and good technological properties (quick drying, low losses in harvesting the hay).

Meadow communities of the **third level of synanthropization** are characterized by a decrease in the overall store of phytomass (143-176 g/m^2). Mosses are almost completely gone, being found only in a small amount (20.6 g/m^2) in the syndow-caraway community. The ratio of aboveground phytomass to underground is 1:9.1-1:9.4. The sward is low-growing, with the greater part of the aboveground phytomass being concentrated in the 0-7 cm horizon. A large part of the aboveground phytomass (from a third to half) is made up of less-productive pasture short herbs: *Carum carvi, Alchemilla tubulosa, taraxacum officinale, Achillea millefolium, Plantago media*. The role of grasses is significantly reduced, with a transition from

dominance of high (timothy grass) and semihigh ones (cock's-foot grass, meadow fescue) to typically pasture short grasses (bluegrass *Poa pratensis*, red fescue *Festuca rubra*) being noted among them. The mass of grasses in the herbage amounts to approximately one third. Legumes reach their maximum in the bluegrass–white-clover community, where white clover accounts for 41% of the whole store of aboveground phytomass. The mass of synanthropic species varies from 55 to 63%.

The underground phytomass is even more concentrated in the layer near the surface.

The herbage's fodder merits are high; well edible species predominate: white clover *Trifolium repens* bluegrass, red fescue, etc.

The knotweed community, which is at the **fourth level of synanthropization**, is distinguished by extremely low productivity. The overall store of phytomass is 315 g/m^2, including 34 g/m of aboveground phytomass and 281 g/m^2 of underground. The ratio of aboveground phytomass to underground is 1:8.3. Knotweed alone, or way-grass *Polygonum aviculare*, is predominant in the herbage, forming 84% of the aboveground phytomass. The vertical profile of the herbage is shortened; three quarters of the aboveground phytomass is located in the layer near the ground (0-7 cm); the rest, in the 7-20 cm horizon. Edibility is good.

The root systems are concentrated in the surface layer of 0-5 cm (83% of the phytomass); only 2% of the mass of aboveground organs reaches the depth of 10-15 cm.

CONCLUSION

Postforest upland meadows are formed on the west slope of the Central Urals on deluvium of schists with an admixture of limestone. The chemical composition of the weathering products (high contents of calcium and certain other elements) resulted in relative richness of the original sod-podzolic soils that emerged from the forest. In turn, this determined the increased floristic wealth of meadow communities at level I of synanthropization, and also the presence in the herbage's composition of certain forest-steppe plants, although the region of the investigation is in the southern part of the forest zone. In the first stage of formation, soon after the forest is cleared, meadows are still under the environment-forming influence of the surrounding forest vegetation to a strong degree. Evaporation from the soil surface is weakened; the soil is sufficiently, and in small depressions excessively moistened; and signs of gleying are noted in places. The upper soil layer is fairly loose. All of this entails strong development of moss cover of typically forest, green shiny mosses (*Hylocomium splendens, Pleurozium schreberi, Rhytidiadelphus triquetrus*, etc.); and in moistened places, with the presence of more hygrophilous *Aulacomnium palustre*. In the herbage's composition, forbs predominate, with a large portion of participation of typically forest species; sodding is insignificant.

With longer hay use (level II of synanthropization), the area of meadow glades expands, and the environment-forming effect of adjacent forest areas on the meadow vegetation decreases accordingly. Moistening becomes optimum, but not surplus. The structure of meadow phytocenoses is rearranged: the predominance of forbs is replaced by dominance of grasses, which is accompanied by increased sodding of the soil surface. Sod-humus soils form in place of forest sod-podzolic ones. The loss of many forest species entails intensification of the position of meadow plants proper, and typically meadow communities arise, with significant participation, and sometimes even predominance of grasses in the composition of the herbage's aboveground phytomass. As the dryness of the surface layer of soil increases, the biomass of the moss cover decreases, and its species composition changes: typically forest, shade-tolerant mosses are replaced by more light-loving species characteristic of open habitats: *Thuidium abietinum, Rhytidiadelphus calvescens, Dicranum bonjeani*.

The transition from hay use to pasture use (level III of synanthropization) is associated with strong compaction of the soil, intensification of surface evaporation and erosion, increased leaching of upper horizons, and degradation of sod soils. The position of grasses weakens somewhat: high and semihigh grasses are replaced by short ones. Many hygrophilous species drop out of the herbage. The floristic composition is significantly impoverished.

Extremely high and prolonged pasture loads lead to even greater compaction of the soil, further degradation of it, and sharp impoverishment of the floristic composition (level IV of synanthropization). In the composition of the phytomass, perennial herbs give way to the annual *Polygonum aviculare*.

As we can see, in the course of synanthropization the floristic composition of upland meadows changes, their layer structure is rearranged, dominants are replaced, and phytocenoses converge.

Meadow communities with the optimum composition and structure are formed at level II of synanthropization, when, in connection with the dominance of high and semihigh grasses, the sward density rises and the photosynthetic surface increases, which, in the final analysis, determines the vegetation's more complete use of the habitat's resources, and its high productivity. Such meadows can be considered to correspond to the concept of potential vegetation (Tüxen, 1956). They can be used as standard areas in creating a reference network for ecological monitoring of fodder lands.

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