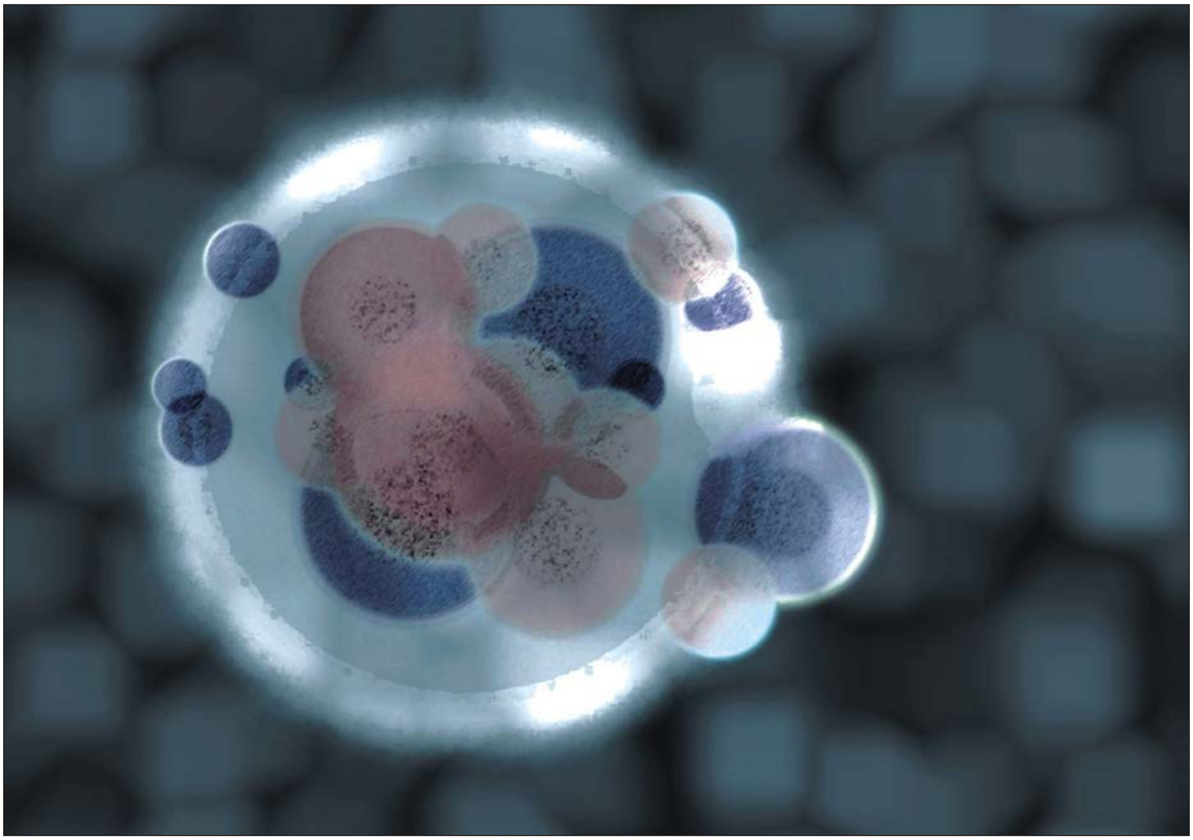

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# The Dynamics of the Structure of Phytomass of Şanliurfa's (Turkey) Steppe Vegetation

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**Abstract:** In 2001-2005, seasonal and annual dynamics of a fractional structure phytomass was studied of, *Artemiso herba albae-Teucrietum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova of Şanliurfa. Middle age reserves analysis different fractions of vegetations matteral lowed to expose it dynamics during the years. In favourable years the average reserves could achieve 130 g $cm^{-2}$. Common reserve of the underground and over ground vegetation material in an ecosystem of steppe's, on average of 5 years, make up 932.6 g $cm^{-2}$. *Artemisia herba-alba* Asso, *Teucrium polium* L., *Thymus longicaulis* C. Presl subsp. *longicaulis* var. *longicaulis*, *Phlomis kurdica* Rech. Fil., *Astragalus lamarckii* Boiss. and *Stipa holosericea* Trin. which are very common in Şanliurfa's steppe vegetation was investigated in terms of their agrobotanical properties. It was found that, phytomass between 41-497 g $m^{-2}$, over soil phytomass 5-29 g $m^{-2}$ and under soil was 35-473 g $m^{-2}$ for the above three formation. The ration between over and under soil phytomass was changing from 1/0.3 to 1/0.7. About 30-50% of general phytomass was found to belong to *Artemisia herba-alba*, *Teucrium polium*, *Thymus longicaulis*, *Phlomis kurdica*, *Astragalus lamarckii*, *Stipa holosericea*. A significant amount (90%) of over soil phytomass was 0-30 cm over soil and a significant amount (80%) of under soil phytomass was 0-20 cm over the upper soil layer. When over soil phytomass was examined in terms of their agrobotanical fraction's (*Poaceae, Fabaceae* and various grasses. *Fabaceae* was made up a very small fraction (3.7 $cm^2$). On the other hand, this value was 59.1-183.6 $cm^2$ for *Poaceae* and it was 48.5-79.1 $cm^2$ for various grasses. As a result, it was found that, over soil phytomass was settled as two levels (10-30 and 20-60 cm) while under soil phytomass was settled as one level (0-20 cm) in steppe.

**Key words:** Şanliurfa, step, vegetation, phytomass structure, dynamics

## INTRODUCTION

Şanliurfa is situated in the south-east of Turkey (Fig. 2). Şanliurfa extended 36 41' 28'' N latitude with 37 57' 50'' N latitude and between 37 49' 12'' E longitude with 40 10' E longitude. The altitude of the area changes between 350-1200 m. The climate is cold and rainy in winter, hot and dry in summer. The economy of the province currently depends upon export demand. Its cultivable land is used mostly to grow cereals. Wheat is the main crop followed by barley and lentil (Anonymous, 2000). There is also chickpea farming and pistachio culture. Its industrial crops and cotton are sesame (Fig. 1).

Şanliurfa has characteristic Irano-Turanian flora with some Mediterranean elements also. The most common woody species in the vegetation as follows: *Eleagnus angustufolia*, *Prunus amygdalus*, *Platanus orientalis*, *Juglans regia*, *Betula pendula*, *Amygdalus arabica*, *Fraxinus angustifolia* subsp. *syriaca*, *Celtis tournefortii*, *Crataegus aronia*, *Cornus mas*, *Morus alba*, *Paliurus spina-christi*, *R. canina*, *Astragalus* spp., *Olea europaea*, *Pistacia khinjuk*, *P. terebinthus*, *P. vera*, *Quercus infectoria*, *Q. brantii*, *Ficus carica* and *Populus euphratica*.

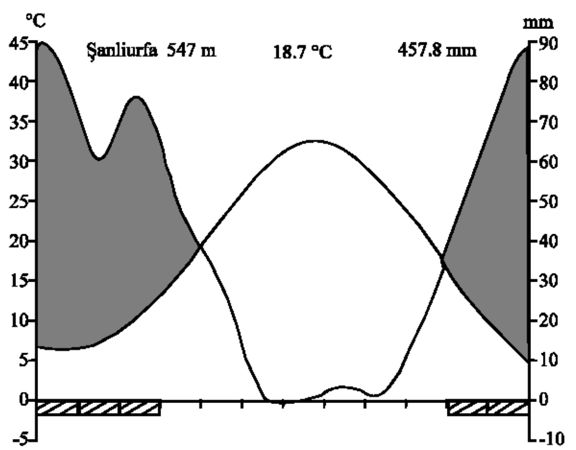

Fig. 1: Ombrothermic diagram of Şanliurfa, Turkey

Like as forests, desert, semi desert, pasture and phrygana, steppe vegetation is widespread in Şanliurfa's

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plant cover (Zohary, 1973; Türkmen *et al.*, 2005). 75.5% of Şanliurfa's land which is 18.584 km$^2$ is steppes spreading from 400 to 2000 m. Mostly in South and South-East side steppes, xerophytic species of *Artermisia, Stipa, Botryochloa, Koeleria, Thymus, Astragalus, Ziziphora* genus are dominant. This lands are rich of $CaCO_3$. Yearly rainfall is between 400-450 mm (Anonymous, 2004).

Semiarid mediterranean climate occurs in research area. According to Emberger the precipitation-temperature coefficient Q) is 42.94 (Akman, 1990). Annual mean temperature is 18.7°C. The maximum mean temperature (M) is 46.8°C, in July. The minimum mean tempereature (m) is -6.8°C, in February. Annual rainfall is about 457.8 mm (Anonymous, 2004) and the seasonal precipitation regime is Winter, Spring, Autumn and Summer. This is the first variant of the East Mediterranean precipitation regime. The ombrothermic diagram shows dry and rainy period (Fig. 1).

Especially, 463 species are with deflowers, 173 species are with monocotyledones. Angyosperms form 98.2% of steppe flora. According to the investigation results, 798 (14.4%) species in Turkey's flora, which his represented with 4500 species, form the floristic composition of steppe vegetation (Atamov *et al.*, 1996; Atamov *et al.*, 1998). *Poaceae, Asteraceae, Lamiaceae, Fabaceae, Liliaceae* can be listed as the most important families of vegetation (Davis, 1965-1985).

Since, of steppe the vegetation is in different elevations from sea, their ecological environments is different and this coursed to differences in their floristic composition and differences in their phytosenologic structure. Regarding to this, Şanliurfa's steppe vegetation is divided into four phytosenotypes.1; Main steppes 2; Xerophyte shrubs steppes 3; Semideserted steppes 4; Mountain kriophyl steppes.

The investigation of some kinds of phytocenose phytomass, with vertical distribution and properties of fractions of phytocenose phytomass enable to determine the importance of phytocenose phytomass in vertical structure of vegetation (Sukacov, 1972). Elaborately investigated layering of forest phytocenoses. Phytomass distribution of plants in phytocenoses on the ground and underground is one of the seasonally important elements. Except forests in grassland, especially steppe of the phytocenoses layering is difficult to distinguish. For example, biomorphs, one of the steppe phytocenoses and their morphological characteristics don't show as very certain differences as they do in forests. Vertical structure and phytomass of the steppe phytocenoses hod been investigated and well understood by the researchers: (Dokman, 1960; Şhalit, 1960; Makarova and Fartushina, 1972; Korneyeva, 1974; Semyonova-Tyan Şanskaya 1977; Sims and Singh, 1978; Danilov, 1983; Rabotnov, 1983; Lebedeva, 1984; Atamov, 2000; Atamov, 2001; Titliyanova, 1977; Bazileviç *et al.*, 1988), in this proposed research, suggest that the consecutive investigations for formation steps of one layering and every vegetation term of any phytosenoses should be investigated to determine the distribution of phytomass on layers.

It is quitted difficult to place every plants of steppe phytocenoses into an certain layers by measuring optimum length of plants. Mostly, structures of some species that are rare in phytocenoses and phytocenologic role are ignored. For example, in the steppe vegetation of Şanliurfa *Colchicum cilicium* (Boiss.). Dammer, *Colchicum persicum* Baker, *Vicia cordata* Wulf., *V. hybrida* L. etc. have important role in the structure of phytocenoses in autumn.

Therefore, in the duration of vegetation common observable cover of phytocenoses and species, separately, need measuring more than once. This type of measuring enables to understand. Formation of vertical structure of vegetative organs in different species and phytomass dynamics of vegetation in different seasons. In addition to investigate the analytic relations of phytomass structure to vertical structure in steppe phytocenoses, investigations of separately dominant species and agrobotanic fractions, such as cereals, legumen and some grasses, for their productivity in layers are absolutely needed. As a result, this type of investigations will explicitly clarify the role of separately dominant species and agrobotanical fractions in the formation of vertical structure of steppe phytocenoses.

Similar analytic studies are important in terms of investigation of vertical structure of underground steppe vegetation (Şalit, 1960; Salit, 1958-1960; Makarova and Fartuşina, 1972; Sims and Singh, 1978; Danilova, 1983; Lapinskine, 1986; Atamov, 2001).

## MATERIALS AND METHODS

The distribution of vertical and structure of steppe pytocenoses in Şanliurfa were studied for the dominant formations, namely *Artemisia herba albae-Teucrietum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova (Braun-Blanquet, 1965; Weber, 2000) in steppes of Tektek mountain, Fatik mountain, Birecik dam arae, Karkamiş dam area, Mezra and Ceylanpinar State Farm similar destinations during 2002-2005. Between 2002-2005, once a month, research tours have been organized to Tektek mountain, Fatik mountain, Birecik and Mezra and Ceylanpinar State Farm. These regions are important geobotanical regions. Research materials include *Artemiso herba albae-Teucrietum*

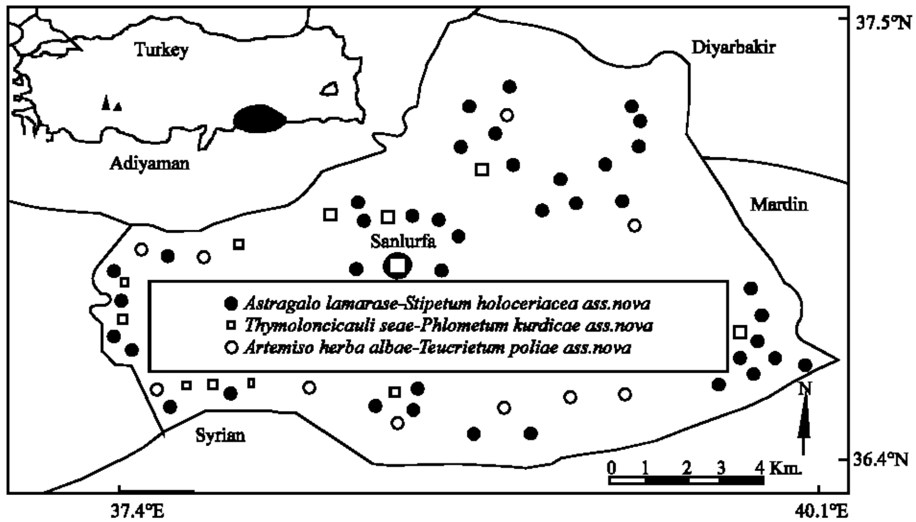


Fig. 2: Map of the territory studied. Dashed curve specifies the territory, Which was intensively studied. Distribution of the respective communities according to the releve/ date is given

*poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass. nova which are widespread in steppe formations in these regions (Fig. 2).

The structure of phytomass fraction has been studied as annual green phytomass(G), over soil dried phytomass (D), dried-litter phytomass(L), subsoil dead phytomass in soil(R), total dead subsoil phytomass (D+L+V), dead subsoil phytomass(V), total phytomass (G+R+D+L+V). Those parameters, as products of herbaceous ecosystems, have been studied according the bu methods (Vagina and Şatochina, 1976; Bazilevic *et al*., 1988) but subsoil phytomass has been studied according to the method by according to (Şhalit, 1958-1960; Lapinskine, 1986). Over soil phytomass in 1 $m^2$ and subsoil phytomass in 0.25 $m^2$, 5 times a month, were studied in *Artemiso herba albae-Teucerietum poliae* ass. nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass. nova formations. Obtained results have been evaluated statistically (Lakin, 1973).

The researched species are very common in the research destinations at the elevations of 400-1200 m. The coldest month in the years was January and average monthly temperature ranges from 3.2 to 6.5°C, while the hottest month in the years is July and monthly temperature ranges from 32.4 to 39.4°C. Because rainfall events in Gobustan is lower that 34% of yearly evaporation summers are always dry. Rainfall events are very common in winter and fall. The yearly rainfall amount is between 316.5-458 mm in the region. The more the climate is cold and most, the more the climate is dry and hot in Tektek mountain and Fatik mountain (Anonymous, 2004).

Korcagina used conduct the research (Korcagina, 1976). The three formations of *Artemiso herba albae-Teucrietum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova were investigated and measured in plots of 100 $m^2$ size. Three measuring per month for each phenophase for each species in phytocenoses were done and 5 year results were obtained. Similarly, ground and underground phytomass in each layer of 10 cm thickness of soil were determined. These measuring was performed with 10 replications in 1 $m^2$ plots for phytomass on the ground and in 50 $cm^2$ plots for underground phytomass. The sampled grass mass on the surface soil was fractionated as cereals, legumes and other grasses.

## RESULTS AND DISCUSSION

Subsoil and over soil phytomass change according to steppe phytosenotypes and spread regions. This variation is seen according to meteorological conditions of the year especially when it rains. Depends on the steppe phytocenotypes, seasonal changes in climate properties separated from each other definitely. As a result, plant is exposed to unclosed moisture depression. This depression is high especially in deserted steppes but as it decreases in germinated Graminea main steppes and xerophytic bushed middle mountain steppes it decreases more in high mountain kriophyle pasture. This variation shows it in phytasenologic properties as well as in subsoil and over soil phytomass of vegetation (Table 1).

As shown in Table 3 change ratio of over soil phytomass is different in various steppe phytosenotypes but this ratio is close in shrub mountain steppes (13.5-28.7 sent ha$^{-1}$) and main stapes (12.6-24 sent ha$^{-1}$). This similarity is also seen in undersoil phytomass (225.0-450.0 and 219.7-473.0 sent ha$^{-1}$). However, when looked at quantities, this is a similarity between deserted steppes and kriophyle shrub steppes but this similarity is only at the base of quantity. The content of components of phytomass is definitely different. As total change of phytomass in Şanliurfa's steppe vegetation is restricted about 40.9-497.0 sent ha$^{-1}$.

In 2002-2005, according to seasons, between March-October, seasonal dynamic of green mass, dried over soil phytomass, dried- litter over soil phytomass, dead phytomass and general over soil phytomass in *Artemiso herba albae-Teueritum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova formations are given in Table 4. As seen in the Table, these parameters change according to seasons and formations. In *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova formation, phytomass of separate fractions are more than other two formations (*Artemiso herba albae-Teucrietum poliae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova). There for, in *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova, over soil green mass (G) 2.8-18.9 sent ha$^{-1}$ in *Astragalo lamarki-Stipetum holocericeae* ass.nova 1.2-14.9 sent ha$^{-1}$, in *Artemiso herba albae-Teueritum poliae* ass. nova 1.5-13.8 sent ha$^{-1}$, appraise about these values (Fig. 3). As shown in Fig. 3 in each three formations, green phytomass begins from March shows a clear increase and shows maximum increase at the end of may and middle of June. In the fallowing months it decreases and it is minimum in November. The reasons for this increase are high temperature humidity in the soil, this factor give convenient environment to plants which are in efermose 2. Amount of green phytomass and dynamic properties of *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Artemiso herba albae-Teueritum poliae* ass.nova are close to each other but they are different from *Artemiso herba albae-Teucrietum poliae* ass.nova. As seen in Table 4, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova the amount of phytomass (D) which dried but not separated from plant is higher and it is at the border of 0.6-9.1 sent ha$^{-1}$ but it changes at the border of 0.3- 6.3 sent ha$^{-1}$ in *Artemiso herba albae-Teucrietum poliae* ass.nova. In each three formations, from the beginning of Marc to middle of June there is a gradual increase but from the middle of summer it increase gradually and it reaches the maximum value in the beginning of Autumn (Fig. 3). In investigated steppe formations, quantity of phytomass. Fraction (C) of dried litter plant leftovers in *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova changes between 2.3-8.7 sent ha$^{-1}$, in *Artemiso herba albae-Teucrietum poliae* ass.nova between 1.4-5.8 sent ha$^{-1}$ in *Astragalo lamarki-Stipetum holocericeae* ass.nova between 1.5-5.3 sent ha$^{-1}$ (Table 2).

Table 1: Quantities of total phytomass, over soil phytomass and subsoil phytomass in Şanliurfa steppe vegetation

| | Phytomass (Sent ha$^{-1}$) | | |
|---|---|---|---|
| Phytosenotypes | Over soil | Subsoil | Total |
| Deserted steppe | 5.0-11.2 | 40.0-147.3 | 45.0-158.5 |
| Main steppe | 12.6-24.0 | 219.7-473.0 | 242.3-497.0 |
| Xerophyte shrub steppe | 13.5-28.7 | 225.0-450.0 | 238.5-478.7 |
| Mountain kriophyl steppe | 6.1-9.9 | 34.8-128.5 | 40.9-137.0 |

*-sent = 100 kg, ha = hectare

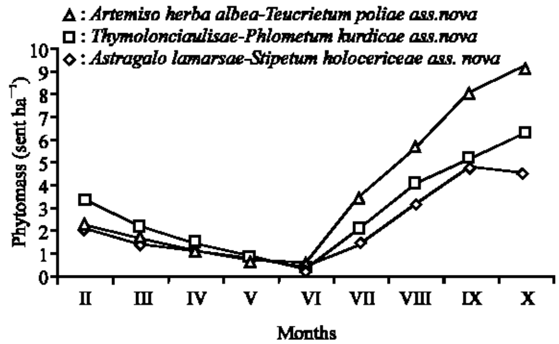


Fig. 3: Seasonal dynamics of green phytomass elation

In each three formations, seasonal change of dynamic of L decreases from the beginning of Marc to middle of summer gradually but later it increases until middle of Autumn (Fig. 5). This increases, in general is related to increased green phytomass in this period and dried over soil parts of efomerosez and efomeroseoid species which completed their short life period, that is, quantity of green phytomass and quantity of dried-litter phytomass have right ratio (Fig. 3-5). While seasonal dynamic of g changes Conversely in this case, in the maximum period of G, D and L are maximum valves G is minimum (Fig. 3-5).

D and L are separated fraction of dead over soil phytomass and their seasonal total change is at the border of 2.9-17.3 sent ha$^{-1}$ in *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova, 2.3-10.3 sent ha$^{-1}$ in *Artemiso herba albae-Teucrietum poliae* ass.nova, 1.8-11.0 sent ha$^{-1}$ in *Astragalo lamarki-Stipetum holocericeae* ass.nova (Table 4). As seasonal change

Table 2: Seasonal dynamics of phytomass of green (G), dried (D) and dried-letter (L) in *Artemiso herba albae-Teucrietum poliae* ass.nova (I), *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova (II) and *Astragalo lamarki-Stipetum holocericeae* ass.nova (III) formations

| | | Investigation period (Months) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraction of oversoil phytomass | | III | IVa | IVb | V | VI | VII | VIII | IX | X |
| Greenmass (G) | I | 1.5 | 2.7 | 8.3 | 13.6 | 13.8 | 12.9 | 11.5 | 9.4 | 3.7 |
| | II | 1.2 | 2.9 | 7.5 | 14.4 | 14.9 | 14.2 | 12.1 | 10.2 | 5.3 |
| | III | 2.8 | 4.1 | 12.3 | 18.9 | 17.5 | 17.3 | 15.4 | 14.1 | 6.7 |
| Dried mass (D) | I | 2.1 | 1.5 | 1.1 | 0.8 | 0.5 | 1.5 | 3.2 | 4.8 | 4.5 |
| | II | 3.4 | 2.2 | 1.5 | 0.9 | 0.3 | 2.1 | 4.1 | 5.2 | 6.3 |
| | III | 2.3 | 1.7 | 1.2 | 0.7 | 0.6 | 3.5 | 5.7 | 8.1 | 9.1 |
| Dried-litter mass (L) | I | 3.6 | 2.1 | 1.9 | 2.2 | 1.8 | 1.4 | 2.7 | 3.4 | 5.8 |
| | II | 2.7 | 1.8 | 1.7 | 1.9 | 1.5 | 1.7 | 5.1 | 5.3 | 4.7 |
| | III | 3.2 | 3.1 | 2.8 | 3.4 | 2.3 | 5.2 | 6.2 | 8.7 | 8.2 |
| Dead mass (D+L) | I | 5.7 | 3.6 | 3.0 | 3.0 | 2.3 | 2.9 | 5.9 | 8.2 | 10.3 |
| | II | 6.1 | 4.0 | 3.2 | 2.8 | 1.8 | 3.8 | 9.2 | 10.5 | 11.0 |
| | III | 5.5 | 4.8 | 4.0 | 4.1 | 2.9 | 8.7 | 11.9 | 16.8 | 17.3 |
| Over soil mass (G+D+L) | I | 7.2 | 6.3 | 11.3 | 16.6 | 16.1 | 15.8 | 17.4 | 17.6 | 14.0 |
| | II | 7.3 | 6.9 | 10.7 | 17.2 | 16.7 | 17.9 | 21.3 | 20.7 | 16.3 |
| | III | 8.3 | 8.9 | 16.3 | 23.0 | 20.4 | 26.0 | 27.3 | 30.9 | 24.0 |

Table 3: Annual dynamics of plant phytomass in germinated main steppes (*Graminetum*)

| Years | Green mass | Dried mass (D) | Dried-litter mass (L) | Live subsoil mass | Dead subsoil mass | Subsoil mass | Dead mass | Total fitomass |
|---|---|---|---|---|---|---|---|---|
| 2001 | 164.3 | 140 | 120 | 415 | 312 | 727 | 572 | 1151.3 |
| 2002 | 135.4 | 83 | 79 | 310 | 286 | 596 | 448 | 893.4 |
| 2003 | 92.1 | 97 | 68 | 298 | 185 | 483 | 350 | 740.1 |
| 2004 | 110.2 | 68 | 53 | 327 | 336 | 663 | 457 | 894.2 |
| 2005 | 126.5 | 56 | 58 | 394 | 350 | 744 | 464 | 984.0 |
| Average | 126.7 | 88.8 | 75.6 | 348.8 | 293.8 | 642.6 | 458.2 | 932.6 |

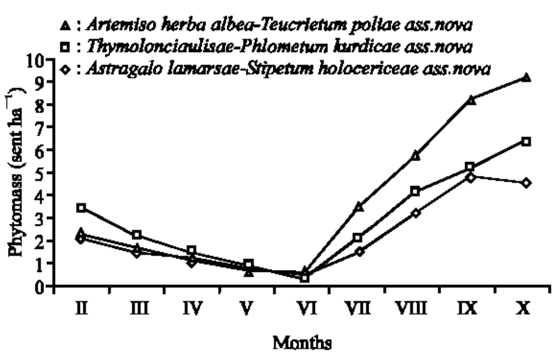


Fig. 4: Seasonal dynamic of dried phytomass (D) in steppe vegetation

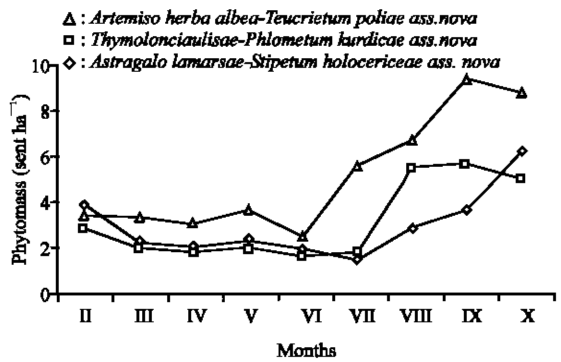


Fig. 5: Seasonal dynamic of dried-litter phytomass (L) in steppe vegetation

D+L decreases from beginning of March until middle of summer but later it reaches the maximum at the beginning of October (Fig. 6).

Total green mass (G) and dried mass (D+L) give the general oversoil phytomass (G+D+L) (Fig. 7). In investigated each formation, seasonal change of G+D+L is minimum at beginning of spring and it is maximum at the lend of summer and at the beginning of Autumn. G+D+L change at the border of 8.3-30.9 sent ha$^{-1}$ in *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova, 6.3-17.6 sent ha$^{-1}$ in *Artemiso herba albae-Teucrietum poliae* ass.nova and 6.9-21.3 sent ha$^{-1}$ in *Astragalo lamarki-Stipetum holocericeae* ass.nova Seasonal dynamic of this change is given in Fig. 5. In each three formation, G+D+L increases from beginning of Spring until June. A stagnation is observed during July. Later, a decrease is seen from October. From the point of were of phytomass, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova has more phytomass with respect to other two formations.

In addition to parameters (G,D,L) which have been shown since 2000, in subsoil phytomass, annual rust system, live(R) and dead (V) mass of root were investigated. In 1991-1998, change of dynamic was analyzed in formations and average values were found and these are given in Table 3.

As shown in Table 3, these parameters show changeability in some years. The important factor causing this changeability is that 2001-2002 years were rainless.

Table 4: Annual(2001-2005) quantity (g/m$^2$) change of phytomass in steppe vegetation

| Fractions of phytomass | *Artemisio herba-alba-Linetum microphilae* | | | *Stipetum holoseriserae Teucrium-poliae* | | | *Astragala lamarkiae-thymbra spicatae* | | | *Thymo lancicaulisae-Teucrium poliae* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2005 | 2001 | 2002 | 2005 | 2001 | 2002 | 2005 | 2001 | 2002 | 2005 |
| Green Mass | 6.5+0.6 | 8.6+1.6 | 12.5+0.2 | 9.3+1.8 | 14.7+1.7 | 18.3+0.3 | 8.2+1.6 | 10.5+2 | 16.3+1.3 | 4.2+0.8 | 6.7+1.5 | 9.8+1.8 |
| Dead-Green mass | 16.4+1.7 | 17.4+0.8 | 15.9+1.7 | 17.8+0.7 | 19.5+0.8 | 22.6+0.5 | 14.2+1.7 | 12.8+1.5 | 15.9+1.4 | 10.3+1.5 | 12.4+1.1 | 10.3+1.7 |
| Total over soil mass | 22.9 | 26 | 28.4 | 27.1 | 35.2 | 40.9 | 22.4 | 23.3 | 32.2 | 14.5 | 19.1 | 20.1 |
| Live subsoil mass | 458+51 | 526+22 | 734+35 | 679+38 | 836+41 | 1126+56 | 1183+57 | 1150+62 | 1475+67 | 627+15 | 834+14 | 762+16 |
| Dead subsoil mass | 362+21 | 475+41 | 698+39 | 563+51 | 792+36 | 965+41 | 878+17 | 1056+69 | 1127+61 | 542+17 | 658+14 | 627+13 |
| Total subsoil mass | 820 | 1001 | 1432 | 1242 | 1628 | 2091 | 2161 | 2206 | 2602 | 1169 | 1492 | 1389 |
| Total phytomass | 842.9 | 1027 | 1460.4 | 1269 | 1663.2 | 2131.9 | 2163.4 | 2289.3 | 2534.2 | 1183.5 | 1911.1 | 1409 |

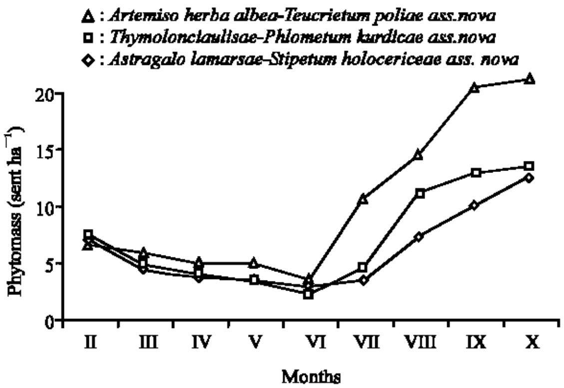


Fig. 6: Seasonal dynamic of dried phytomass (D+L) in steppe vegetation

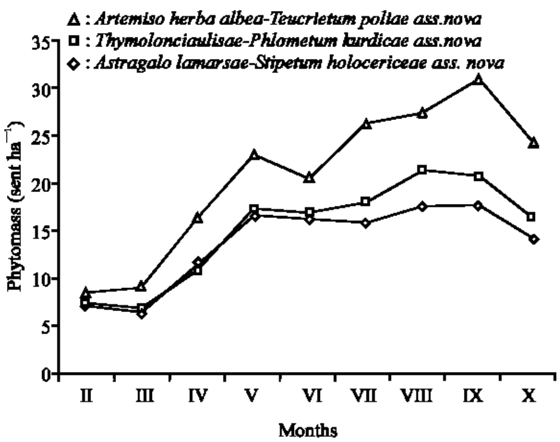


Fig. 7: Seasonal dynamics of over soil phytomass (G+D+L) in steppe vegetation

Therefore, in steppe vegetation phytomass is minimum, but in 2001, 2004 and 2005 abundant rainfall caused an increase in phytomass. The results obtained in 4 year period of investigation are taken and properties of structure of phytomass fraction for Şanliurfa's steppe vegetation were determined (Fig. 8).

Parameters (G+D+L+R+V) shown were studied separately in steppe phytosenotypes in 2000-2004, in deserted steppes (*Artemiso-herba-albae-Linetum microfilae* formations), in germinated Graminea main steppes (*Stipetum holoseriserae*), in middle mountain xeserophytic shrubs steppes (*Thymo-Astragaletum strictifoliae*) and high mountain kriophyle pasture steppes (*Astragaletum lamarkiae*) (Table 6). These parameters change according to the type of phytosenotypes of steppes. The general highest phytomass of these phytosenotypes gradually is in middle mountain shrub xerophytic steppes (*Thymeto-longicaulisae*) and then high mountain kriophyte pasture steppes (*Stipetum holosericeae*) and at the last in deserted steppe (*Artemiso herba-albae-Linetum microfilae* ) (Table 4).

Nual change of dynamic of these parameters (G,D+L,R,V) and change of each parameters show similarity in respect of years (Fig. 9). According to this, the amount of in comparison with the amount of V decreases in each formation of phytosenotype with respect to formations. İncrease in these parameters is according to the following sequence; *Artemisio herba-alba-Linetum microphilae* < *Astragala lamarkiae-Thymbra spicatae* < *Stipetum holoseriseraeTeucrium-poliae* < *Thymo lancicaulisae-Teucrietum poliae* In 2000-2004, the range limit of these parameters valuated to formations is between G-4.2-18.3 g m$^{-2}$; D+L 10.3-22.6 g m$^{-2}$; R-458-1477 g m$^{-2}$; V-362-1156 g m$^{-2}$ (Table 4 and Fig. 9).

As a result, due soil and subsoil phytomass of steppe vegetation change according to meteorological condition of the year. Change between 5.0-28.7 sent ha$^{-1}$ and subsoil phytomass change between 40.9-497.0 sent ha$^{-1}$ values. Green phytomass (G) begins from March increases continuously until end of May and it reaches its maximum level later it decreases gradually until the end of September. Dried phytomass (D) reduced from March until end of June but later it increases gradually and it reaches its maximum level at the beginning of November. Dried-litter phytomass (L) reduced gradually. From March until June but later it shows an increase until November-D+L are dead phytomass and they are added to formation of soil. As seasonal, D+L decrease from March until June but later they reaches the maximum level. Subsoil

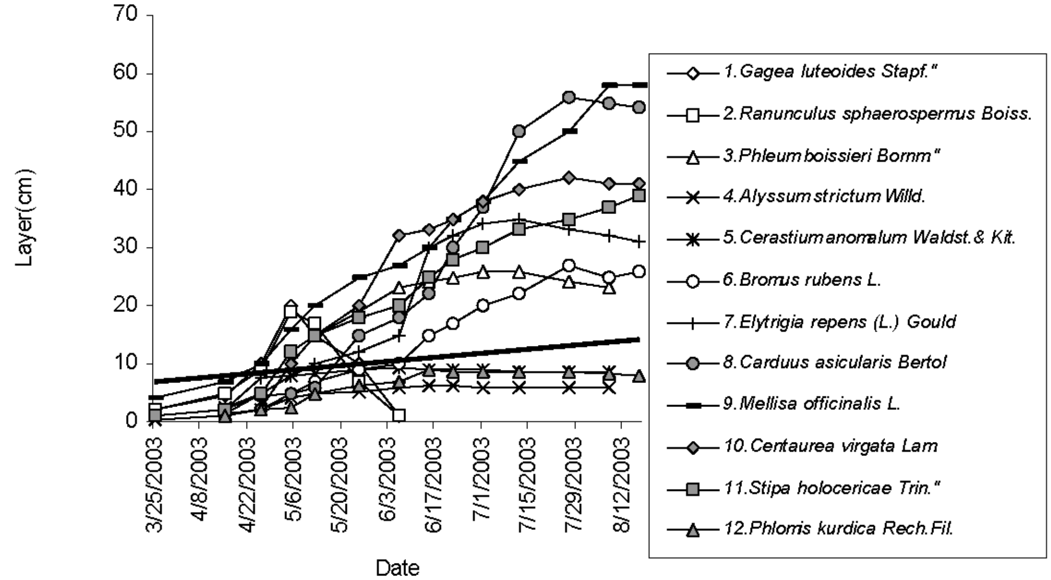


Fig. 8: The seasonal change in height of important species in *Stipeto-varioherbosum* formation

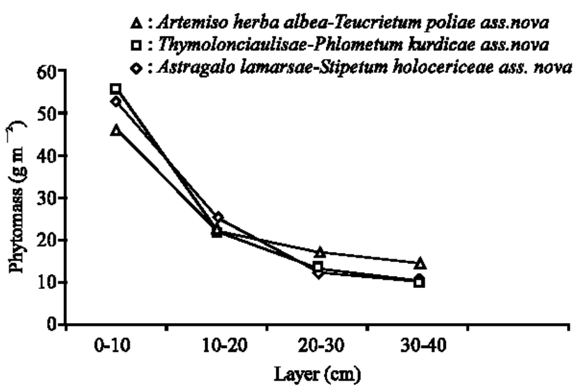


Fig. 9: (Fraction, A-Various grasses) The vertical distribution of the over soil general phytomass in formations of fraction

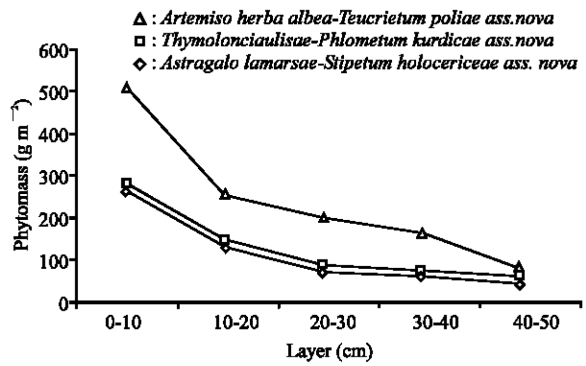


Fig. 11: The vertical fractional distribution of the soil general phytomass in formations of fraction

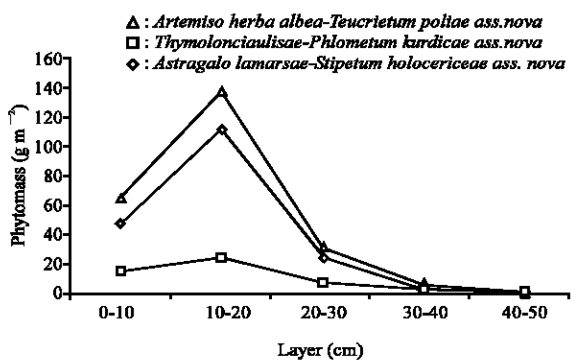


Fig. 10: The vertical distribution of the sub soil general phytomass in formations of fraction

phytomass and their ratio change from 1:11 to 1:37. The ratio of phytomass of subsoil and over soil were low(1:4 to 1:8) in the wet years (2001, 2002, 2005,) and high in dry year (2003, 2004). Due to grazing and lawning, for both in drought and wet years, the ratio has decreased Atamov (2004).

Vertical distribution of surface and subsurface soil phytomass fractions and distribution of hygroscopic moisture in surface soil phytomass are registered as in the Fig. 8-12.

Figure 12A-C The vertical fractional distribution of higroscopic water in over soil phytomass of steppe vegetation (Fraction A. *Graminea* B. Various herbs C. *Fabaceae*).

Table 5: The vertical fractional distribution of hygroscopic water in overground phytomass of Şanliurfa's dominant formations of steppe vegetation

| Agrobotanical groups | Layer (cm) | Formations: *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova | *Astragalo lamarki-Stipetum holocericeae* ass.nova | *Artemimiso herba albae-Teueritum poliae* ass.nova |
|---|---|---|---|---|
| Graminea | 0-10 | 38.0 | 45.4 | 52.0 |
| | 10-20 | 45.3 | 50.8 | 51.4 |
| | 20-30 | 37.1 | 50.2 | 47.2 |
| | 30-40 | 31.9 | 54.1 | 36.6 |
| | 40-50 | 32.8 | 50.0 | 42.9 |
| | 50-60 | - | - | 40.0 |
| | Average | 39.0 | 49.4 | 50.3 |
| Leguminose | 0-10 | - | 56.7 | - |
| | 10-20 | - | 68.0 | - |
| | 20-30 | - | - | - |
| | 30-40 | - | | - |
| | Average | - | 59.8 | - |
| Various herbs | 0-10 | 42.4 | 59.3 | 55.3 |
| | 10-20 | 54.6 | 62.7 | 59.6 |
| | 20-30 | 49.6 | 56.0 | 56.9 |
| | 30-40 | 40.9 | 63.2 | - |
| | 40-50 | 52.2 | 52.6 | - |
| | 50-60 | - | - | - |
| | Average | 50.7 | 60.7 | 57.0 |
| Average of the formations | | 44.9 | 56.6 | 53.7 |

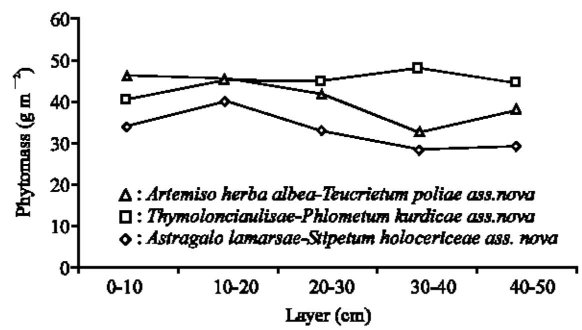


Fig. 12A: The vertical fractional distribution of higroscopic water in over soil phytomass of steppe vegetation

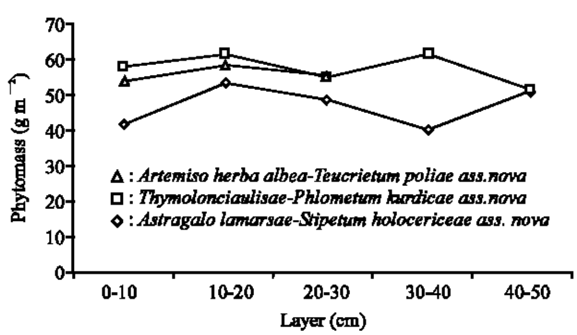


Fig. 12B: The vertical fractional distribution of higroscopic water in over soil phytomass of steppe vegetation

These results suggest that the roles of different agrobotanical fractions in constituting the productivity in steppe phytocenoses enable and direct the researcher to

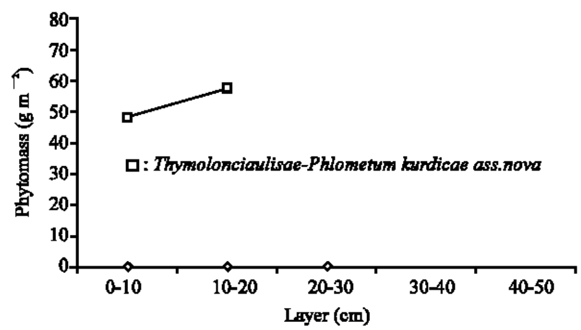


Fig. 12C: The vertical fractional distribution of higroscopic water in over soil phytomass of steppe vegetation

make an elaborately explicitly and scientifically essential multiple categorization of a phytocenoses.

On the stems of the most species in steppe vegetation leaves are set 10-30 cm above the ground. The rots harbour boring generative organs are set higher than 10-30 cm on the stem. In our former research, we separated plant species in a range of consecutive categories of heights. In terms of their height dominant plants groups, determined by the number of individuals of similar heights. In terms of their height dominant plant groups, determined by the number of individuals of similar height from the each species different from the rest of the plant population.

As shown in Fig. 6-10 the height of most of the plants in steppe phytocenoses of Azerbaijan is restricted due to moisture content and elevation of the land. Therefore, the most important physiologic body of the plant is in deeper soil profile rather than upper soil layer. However, vertical structure and distribution of phytomass in phytocenoses of the steppe vegetation is simpler than in the others. In temperature and moisture deficit conditions layering due to different height of individuals of plants in inter-layers increase.

During the vegetation period, vertical and horizontal distribution of phytomass and changes in physiologically active organs of a general plant group and its various species always because of the changes in botanical composition of the plants. Vertical structure of grass covers of Şanliurfa and therefore phytomass of steppe vegetation vary in very large extent in a year. Vertical structure of phytomass in steppe vegetation is determined by morphologic and biologic characteristics of the dominant species and composition of phytosenoses. These characteristics are strongly related to climate and soil conditions in the seasons of a year (Table 5).

In all of the three formations, the amount of phytomass of subsoil (547.5-1182.5 g $m^{-2}$) and over soil (126.6-235.8 g $m^{-2}$), respectively, was chanced depending on soil type and its moisture characteristics. *Artemiso herba albae-Teueritum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova and *Astragalo lamarki-Stipetum holocericeae* ass.nova In the researched formations, distribution of vertical fraction of hygroscopic water in phytomass, over soil was investigated. For the three formations, in the leaves of cereals fractions the hygroscopic water content was 31.9-54.1 and 40.9-63.2% for various grasses. For the fractions from cereals, maximum hygroscopic water amount in three formations of species was between 52.0 and 51.4%. This amount of water was contained in second layer (10-20 cm) of phytocenoses. For various grasses of *Artemiso herba albae-Teucrietum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova *and Astragalo lamarki-Stipetum holocericeae* ass.nova, the water content was 54.6, 59.6 and 62.7%, respectively. In *Astragalo lamarki-Stipetum holocericeae* ass. nova formation maximum moisture was contained in second layer (30-40 cm) (Fig. 11). Moisture contend increased from 10 cm depth through 40 cm depth in the soil. This increase is directly proportional to vegetative and generative organs growing in there phytomass of over soil and vertical fraction distribution of leaves.

Moisture content in grass cover, especially vertical distribution of moisture content in steppe vegetation is strongly related to fraction distribution of phytomass due to its roles in structure of agrobotanic fraction and vertical phytocenologic structure of cenose.

The investigation of vertical structure of steppe phytomass and vertical fraction distribution is very important to find the way to use vegetation areas more productive to evaluate their land use planning. For example, if the large amount of phytomass of *Festuceto-varioherbosum* places the lowest layer. These type areas are suggested to use as graze lands, while *Artemiso herba albae-Teueritum poliae* ass.nova, *Thymo loucicaulisae-Phlomisetum kurdiae* ass.nova *and Astragalo lamarki-Stipetum holocericeae* ass.nova have vertical pytomass in the uppest layer, the areas occupied by these formations should be used as lawn lands.

The maximum amount of phytomass over soil is contained in 10-30 cm layer, while the maximum is included in 40-50 cm layer over the soil. The amount of subsoil phytomass decreases as the soil depth. Hygroscopic water content of phytomass in over soil varies in relation to vertical fraction distribution of the phytomass.

This variation depends on, especially in various grasses, the ratio of phytomass of agrobotanic groups to each other, the amount of vegetative and generative fractions and their locations in the layers.

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