INFLUENCE OF ORGANIC FERTILIZATION ON PHYTODIVERSITY OF A *FESTUCA VALESIACA* SCHLEICH. GRASSLAND

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Abstract

The application of organic fertilizers for extended period of time has determined a high biodiversity of the investigated grassland. The objective of this study is to determine the effect of sheep and cattle manure application on grassland and the effect on phytodiversity of a *Festuca valesiaca* Schleich. Type association. A high similarity appears by comparing the phytocenosis from V8 fertilization variant (30 t/ha cattle manure/3 year basis) and that of V9 fertilization variant (40 t/ha cattle manure/3 year basis) (T = 0.49176925, A = -0.05105096), yet differences were not statistically signifficant. The phytocenosis from unfertilized variant (V1), is largely dominated by grasses or *Poaceae* botanical family, with a dominance of 28% in the sward. Within grasses, the species with the highest Adm value is *Festuca valesiaca* L. 15.5%, followed by *Arrhenatherum elatius* L. 4% and *Dactylis glomerata* L. 1.3%

Key words: sheep and cattle manure, phytodiversity, *Festuca valesiaca* Schleich.

Grassland represents a area covered with permanent vegetation comprised with plant species from many botanical families, among the most important are perennial grasses and legumes (Vîntu V. *et al*., 2004).

Grasslands are a major biosphere resource who is responsible for sustaining cca. 1 bilion people from the entire world (Schnyder H. *et al.*, 2010). As the agriculture and production technology developed, human intervention in grassland ecosystems accentuated progressively. Today, the fizionomy of those particular formations, regardless of their origin, is determined first by humans and grazing.

Natural or semi-natural grasslands worldwide are true green oceans, of the greates importance for life on earth and, who were subjected to many research during the time. These vast green areas are closely linked to our life and to conservation of the habitat we live in. Starting from the imense areas ocuppied by grasslands, and their productive potential, we can say that they are an enormous food supply for the future populations (Vîntu V. *et al*., 2004).

Fertilization is one of the main measures to increase the production of all crops, but on grasslands fertilizers have multiple role (Samuil C., *et al*., 2007).

After 1990, with the entry in the “era of biological productions”, the focus was on the restriction of using chemical fertilizers and on the other hand using on a larger scale organic fertilizers.

Organic fertilization influences vegetation composition, naure fertilizer is indicated for use on permanent grassland with a high specific richness (Păcurar F. and I. Rotar. 2004). The quantity of manure applied in order to preserve floristic biodiversity is between 9 to 20 t/ha depending on the trophic level of the soil (Briemle G. and Oppermann R. 2003).

In our country, the quantities of organic fertilizers available are relatively low, and poorely variated, thus they were carrefully used and new organic materials, like food industry byproducts, some with high polluting potential were seeked and used as fertilizers in agriculture.

Maintaining and preserving biological biodiversity, the production of quality superior goods, forces the precise knowledge of the effects of anthropic interventions on natural biocenosys and their habitats, in the context of increased demands for productivity, individual or cooperative farming rentability that own or use permanent grasslands.

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MATERIAL AND METHOD

The experiment was organized on a *Festuca valesiaca* Schleich. type plant association located in Moldavian sylvosteppe, on a slightly inclined ground, with NE exposition, cambic chernozem soil type, low leachability, silt- clay texture, humus content 4,2-4,8% medium supplied with phosphorus (30-37 ppm.) and well supplied with potassium (235-320 ppm.), pH 6.5 to 6.9 in the 0-20 cm layer of soil.

The experiment is monofactorial, with randomized plots in three replicates, which studies the role of sheep and cattle manure in various dozes, in the increase of phytomass and the modification produced in the floristic composition as a result of the changes of soil nutritional status.

We used the following fertilization schemes: V1 – unfertilized control, V2 – 10 t/ha sheep manure anually, V3 – 20 t/ha sheep manure/2 year basis, V4 – 30 t/ha sheep manure/3 year basis, V5 – 40 t/ha sheep manure/3 year basis, V6 – 10 t/ha cattle manure anually, V7 – 20 t/ha cattle manure/2 year basis, V8– 30 cattle manure/3 year basis, V9 – 40 t/ha cattle manure/3 year basis.

Harvesting was done at earing-flowering stage of dominant grasses, results were statistically interpreted by analysis of variance and limit differences. For biodiversity analyses we used the programme PC-ORD, which performs multivariated analysis of ecological data from calculation sheets (Mccune and Grace, 2002)..

This programme sets accent on nonparametric instruments, graphic representations, randomization tests, and trust intervals for analysis on ecological communities. From the wide range of coordinates produced by this programme we used the MRPP (Multi Response Permutation Procedure) and multidimensional scalling NMS Autopillot.

In order to express floristic diversity we used Shannon - Wiener index.

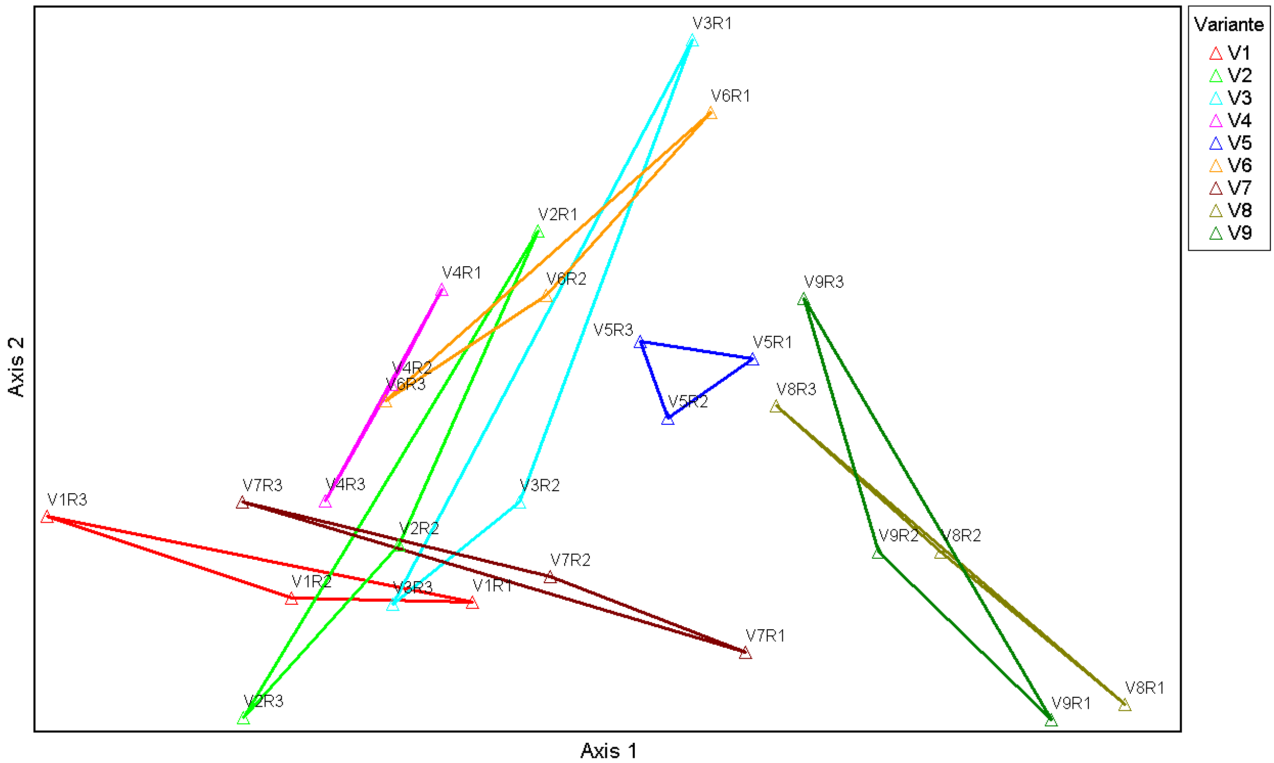

Figure 1 **The display of floristic composition in 2011, influenced by organic fertilization (V1 – unfertilized control, V2 – 10 t/ha sheep manure anually, V3 – 20 t/ha sheep manure/2 year basis, V4 – 30 t/ha sheep manure/3 year basis, V5 – 40 t/ha sheep manure/3 year basis, V6 – 10 t/ha cattle manure anually, V7 – 20 t/ha cattle manure/2 year basis, V8– 30 cattle manure/3 year basis, V9 – 40 t/ha cattle manure/3 year basis)**

RESULTS AND DISCUSSIONS

Overllaping experimental variants, with the help of NMS Autopillot shows the effect of organica fertilization on the sward, with signifficant changes, the floristic composition of the experimental variants does not overllap in the graphic representation (*fig. 1*) which demonstrates that the similarity of the phytocenosis is not very high.

Analyzing the level of the floristic composition, many of the experimental variants compared in table 1 presents statisticall assurance ($p<0.05$). we can say that sheep and cattle manure had a positive effect on phytodiversity.

The comparison between the other experimental variants presents statisticall signifficance as displayed in table 1. In some cases the floristic composition differs substantially, the highest differences were noticed when comparing unfertilized control (V1) to V5 (40 t/ha sheep manure/3 year basis), or to V9 (40 t/ha cattle manure/3 year basis) or to V8 (30 cattle manure/3 year basis) these variants were statistically assured ($p<0.05$). When comparing some phytocenosis among them we see very little differences such as variants V8 compared with V9, V3 and V6, these phytocenosis have no statisticall signifficance. The highest similarities appear when comparing phytocenosis from V8 to V9 (T = 0.49176925, A = -0.05105096) but they don't have statisticall signifficance ($p>0.05$).

Table 1

Comparison between floristica composition of the experiment fertilized with organic fertilizers MRPP in the year 2011 (T – test T, A – group omogenity, p – statisticall signifficance)

Comparison	T	A	p	Signifficance
1 vs. 2	-1.98326376	0.16176496	0.03650052	*
1 vs. 3	-2.30317349	0.19304757	0.02676598	*
1 vs. 4	-2.36237991	0.18857326	0.02328174	*
1 vs. 5	-2.68650711	0.28218949	0.02282212	*
1 vs. 6	-2.50712118	0.24043050	0.02387094	*
1 vs. 7	-2.39250075	0.21858177	0.02639751	*
1 vs. 8	-2.64899814	0.32797543	0.02360858	*
1 vs. 9	-2.67607096	0.30940587	0.02311981	*
2 vs. 3	-1.18799214	0.09415431	0.12048768	ns
2 vs. 4	-2.17885187	0.16398996	0.02810335	*
2 vs. 5	-2.63980969	0.28902926	0.02311355	*
2 vs. 6	-1.42026674	0.12210841	0.08822262	ns
2 vs. 7	-1.51058726	0.10363005	0.06428614	ns
2 vs. 8	-2.47499988	0.26252984	0.02473224	*
2 vs. 9	-2.48373599	0.24663697	0.02441932	*
3 vs. 4	-1.63509050	0.11069962	0.05198249	ns
3 vs. 5	-1.94573711	0.14807509	0.03519705	*
3 vs. 6	-0.85464748	0.07891073	0.18686882	ns
3 vs. 7	-1.52690924	0.09051179	0.06440489	ns
3 vs. 8	-2.33312736	0.22113687	0.02653310	*
3 vs. 9	-2.15199478	0.17275220	0.02738553	*
4 vs. 5	-2.20177200	0.18718416	0.02898521	*
4 vs. 6	-2.17619454	0.19968185	0.02902822	*
4 vs. 7	-2.14440666	0.20560458	0.03148049	*
4 vs. 8	-2.62853063	0.32761666	0.02401676	*
4 vs. 9	-2.56619661	0.26376140	0.02447997	*
5 vs. 6	-1.86041129	0.16065099	0.04243770	*
5 vs. 7	-2.50240604	0.21163087	0.02325966	*
5 vs. 8	-2.34064065	0.21382149	0.02524508	*
5 vs. 9	-2.00878237	0.16136949	0.03381857	*
6 vs. 7	-1.86384419	0.14687291	0.03511258	*
6 vs. 8	-2.35848132	0.23814820	0.02631335	*
6 vs. 9	-2.28201225	0.22608446	0.02763277	*
7 vs. 8	-2.14452133	0.20397141	0.03281377	*
7 vs. 9	-2.39876697	0.19700966	0.02454836	*
8 vs. 9	0.49176925	-0.05105096	0.65218931	ns

In the phytocenosis of control plot *Poaceae* species have a mean participation inthe sward of 28% (tab. 2). Within grasses, the species with the highest Adm value is *Festuca valesiaca* L. 15.5%, followed by *Arrhenatherum elatius* L. 4% and *Dactylis glomerata* L. 1.3%

The botanical families *Cyperaceae* şi *Juncaceae* at this variant are not present.

The family *Fabaceae* has a mean dominance in the sward of 21,6 %. Among *Fabaceae* the highest dominance has *Medicago falcata L.* (9,3 %) followed by *Trifolium pratense* L. (8%).

Among species from other botanical families: *Centaurea jacea* L. With a mean dominance of 6.8 %, *Fragaria viridis L.* cu o with a mean coverage of 6.7 %, *Ranunculus polynanthemus* L. şi *Cerastium pumilum* L.

With 3.5 % mean coverage, *Hieracium baubinii* L. with 2.5 % mean coverage. The general coverage of the sward is 98 %-100%. Floristic diversity in the V1 is shown by index Shannon - Wiener of 2.96, with a maximal value of 3.06 which indicates an average diversity. Average speceis number is 31, minimal 28, and maximal 35 species (*tab. 2*).

Table 2

Floristic structure of plant association types in 2011 under the influence of organic inputs (H= Shanon Index, S=number of species)

Fertilization variants	economic groups				phytodiversity	
	Poaceae	Fabaceae	Cyperaceae and Juncaceae	other species	H'	S
	Valoare medie					
	27.5	37.1	0.3	35.1	2.75	28
V1	28	21.6	0.0	48	2.96	31
V2	27.3	33	0.0	37.9	2.99	29
V3	25	42	0.0	34	2.85	28
V4	31	30	0.0	39	2.87	27
V5	30	39	0.0	31	2.67	29
V6	33	35	0.0	32	2.87	30
V7	27	41	0.0	32	2.76	28
V8	24	47	0.3	29	2.32	26
V9	22	45	0.0	33	2.48	28

After determining the floristic composition of the meadow that experiments were conducted, the type determined is *Festuca valesiaca* Schleich. - *Medicago falcata* L., which is part of the type *Festuca valesiaca* Schleich. specific set steppe zone (Ţucra *et al*., 1987). This type is usually found in xerothermal-continental biotops flat land or moderately pitched ribs, sunny, dry soils, eubazice neutral-weakly alkaline. (Ţucra *et al*. 1987) (*fig. 2*).

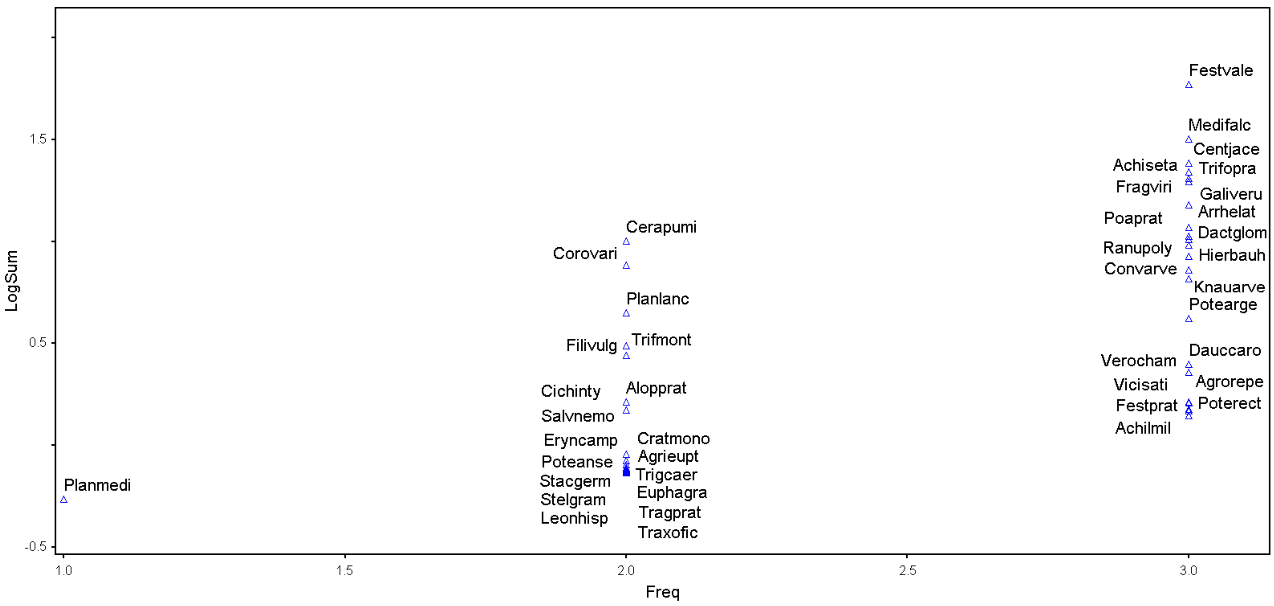

Figura 2 **Phytocoenosis witness dominant frequency curve under the influence of organic inputs** (Legend: Freq= Species frequency, Logsum = Log in base 10 to species frequency, Species: *Agropyron repens* (L.), P.B = *Agrorepe, Arrhenatherum elatius* L., Presl. = *Arrhelat Bromus inermis,* Leyss. = Brominer, *Dactylis glomerata* L. = Dact glom, *Festuca pratensis* Huds. = Festprat, *Festuca valesiaca* Schleich. = Festvale, *Koeleria macrantha* (Ldb.)Schult. = Koelmacr, *Poa pratensis* L. = Poaprat, *Lathyrus touberosus* L. = Lathtoub, *Lotus corniculatus* L. = Lotucorn, *Medicago falcate* L. = Medifalc, *Medicago lupulina* L. = Medilupu, *Trifolium pratense* L. = Trifprat, *Trifolium repens* L. Trifrepe, *Trifolium montanum* L. = Trifmont, *Trigonella caerulea* L. = Trigcaer, *Vicia sativa* L. = Vicisati, *Vicia tetrasperma* (L.) Munch. = Vicitetr, *Carex tomentosa* L. = Caretome, *Carex distans* L. = Caredist, *Carex hirta* L. = Carehirt, *Carex precox* Jacq. = Careprec, *Ajuga genevensis* L. = Ajuggene, *Agrimonia euptoria* L. = Agrieupt, *Achillea milefolium* L. = Achimile, *Achillea setacea* Baumg. = Achiseta, *Allium rotundum* L. = Allirotu, *Capsella bursa-pastoris* L. = Capsburs, *Cardaria draba* L. = Carddrab, *Convolvulus arvensis* L. = Convarve, *Centaurea jacea* L. = Centjace, *Centaurea pannonica* (Heuff.) Hay. = Centpann, *Cerastium pumilum* Curt. = Cerapumi, *Chaerophyllum bulbosum* L. = Chaebulb, *Cichorium intybus* L.

= Cichinty, *Daucus carota* L. = Dauccaro, *Dianthus caryophyllus* L. = Diancary, *Eryngium campestre* L. = Eryncamp, *Eryngium planum* L. = Erynplan, *Euphorbia agraria* M.B. = Euphagra, *Fragaria viridis* Duch. = Fragviri, *Filipendula vulgaris* M. = Filivulg, *Galium verum* L. = Galiveru, *Galium mollugo* L. = Galimoll, *Glechoma hederacea* L. = Glechede, *Heracleum sphondylium* L. = Heraspho, *Hieracium bauhinii* Bess. = Hierbauh, *Knautia kitaibelii* (Schult.) Borb. = Knaukita, *Leontodon hispidus* L. = Leonhisp, *Linaria vulgaris* Mill. = Linavulg, *Miosotis micranta* Pall. = Miosmicr, *Plantago lanceolata* L. = Planlanc, *Plantago media* L. = Planmedi, *Potentilla anserina* L. = Poteanse, *Potentilla argentea* L. = Potearge, *Potentilla recta* L. = Poterect, *Potentilla reptans* L. = Poterept, *Ranunculus polynanthemos* L. = Ranupoly, *Rosa canina* L. = Rosacani, *Rumex crispus* L. = Rumecris, *Salvia nemorosa* L. = Salvnemo, *Stellaria graminea* L. = Stelgram, *Traxacum officinale* Weber. = Tragoffi, *Tragopogon pratensis* L. = Tragprat, *Veronica arvensis* L. = Veroarve, *Veronica chamaedris* L. = Verocham)

In terms of frequency of species in the witness phytocoenosis *Festuca valesiaca* Schleich. - *Medicago falcata* L. besides dominant and co-dominant species there are other species with a higher frequency and coverage such as: *Achillea setacea* Baumg., *Centaurea jacea* L, *Fragaria viridis* Duch., *Trifolium pratense* L, *Galium verum* L., *Arrhenatherum elatius* L., *Poa pratensis* L, *Dactylis glomerata* L., *Ranunculus polynanthemos* L. etc. and species with a lower coverage and frequency, such as: *Plantago media* L. (*fig. 3*).

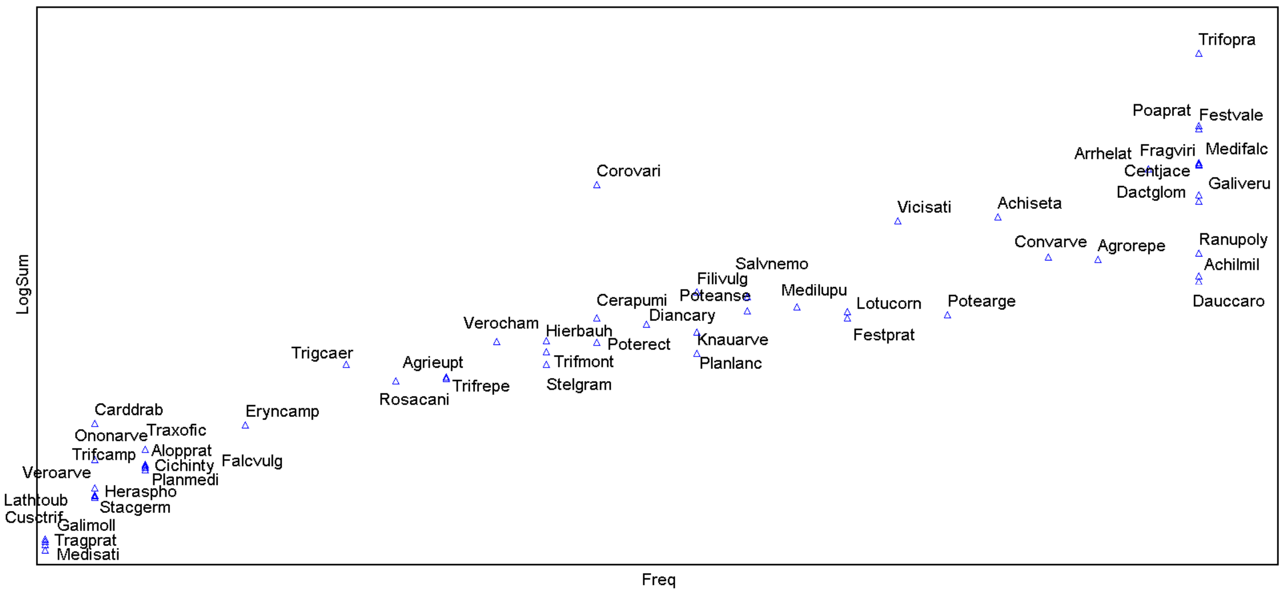

Figura 3 **Curve-dominant frequency phytocoenosis treatments without witness,** (Freq= Species frequency, Logsum = Log in base 10 to species frequency, for species names see legend from *fig. 2*)

Comparing floristic composition of the witness with the floristic composition of other variants appeared that certain species under the influence of organic fertilizers changes its dominance and frequency. Thus, some species in the control showed high coverage like the species: *Festuca valesiaca* Schleich. and *Medicago falcata* L. currently are found in a lower percentage (*fig. 3*).

Other species, such as species *Trifolium pratense* L. we observed that the frequency has increased quite a lot and is classified as dominant species, which is explained by the abundance of the most studied surveying. Other species that change their dominance and frequency are: *Poa pratensis* L., *Achillea setacea* Baumg., *Agropyron repens* (L.), P.B etc.

CONCLUSIONS

After determining the floristic composition of the meadow that experiments were conducted, the type determined is *Festuca valesiaca* Schleich. - *Medicago falcata* L.

In the phytocenosis of control plot *Poaceae* species have a mean participation in the sward of 28%.

After applying organic fertilizers the grassland type found in the control has changed, so species *Trifolium pratense* L. had a very high frequency and dominance, being framed as the dominant species.

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