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Timber, Browse, and Herbage on Selected Loblolly-Shortleaf Pine-Hardwood Forest Stands

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SUMMARY

A thorough vegetation inventory was made on loblolly-shortleaf pine-hardwood stands scheduled by forest industry for clearcutting, site preparation, and planting to pine in north central Louisiana and southern Arkansas. Overstory timber, on the average, contained about equal proportions of softwood and hardwood basal area. Browse plants ranged from 5,500 to over 10,000 per acre, with about 60 to 70 percent desirable for deer. Herbage production averaged 180 pounds per acre on silty soil, but less than 75 pounds per acre on loamy, gravelly and clayey soils. Of the 177 plant species encountered, none were listed as endangered or threatened.

Additional keywords: Overstory, herbage, browse, botanical composition, soils.

Present and projected demands for timber, forage, and other forest resources have increased the need for balanced management programs on commercial forest lands. One concern is site preparation. While it improves timber production, how does it affect other forest values such as browse and herbage?

The objective of this study was to inventory overstory and understory vegetation on loblolly-shortleaf pine-hardwood stands prior to clearcutting and site preparation. These inventories will provide benchmarks to evaluate ecological changes in woody and herbaceous plants during the years following site preparation and planting to pine. With five important soil groups covered, the study areas are generally representative of areas requiring site preparation in the South.

STUDY AREAS AND METHODS

This study, part of a cooperative effort between Timber Management and Range Management Research Units at Alexandria, La., was conducted on forest industry lands in the West Gulf Coastal Plain in Louisiana and Arkansas. Ownerships included Boise Southern Company, Continental Forest Industries, Georgia-Pacific Corporation, International Paper Company, Olinkraft Inc., T. L. James and Company, and Crown-Zellerbach Corporation.

Representatives of the previously mentioned companies, Louisiana Forestry Commission, Soil Conservation Service, Kisatchie National Forest, and Timber and Range Management Research Work Units agreed upon site requirements which would permit application of research findings to the West Gulf Coastal Plains. Five soil groups were selected for study based on textural classification of the B horizon. These are silty, loamy, gravelly, slowly permeable clayey, and very slowly permeable clayey, characterized by Henry, Ruston, Kirvin, Sawyer, and Boswell series, respectively. Textures of A horizons of all soils were generally sandy to silty loams. The Soil Conservation Service assisted in soils identification.

Sampling areas were selected in loblolly-shortleaf pine-hardwood stands scheduled for clearcutting, site preparation, and planting to pine. Each area had more than 500 hardwood stems with over 20 square feet of basal area per acre. Past management consisted primarily of periodic logging and protection from fire. Because logging had removed the highest grade timber, the residual stands did not permit efficient land management. Low-grade hard-

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woods were abundant on all stands and occasionally were dominant. No pines were present on the silty soil, which had developed on a very flat loessial terrace that is poorly drained.

Twenty-nine 0.5- to 4-acre areas were inventoried with 3 to 9 replications per soil group. All tree species 1-inch dbh (diameter at breast height) and larger were considered overstory. Trees in the overstory were measured and counted by species in each of four 0.025-acre circular plots on each sampling area. Merchantable trees on a few areas were cut before inventory; on these areas, basal area and species composition were reconstructed from residual stumps.

Vines and other woody stems less than 1-inch dbh were considered browse because most produce foliage within 5 feet of the soil surface. Browse density (vines and woody stems) was measured and browse crown diameter (excluding vines) was estimated by species in each of four 0.01-acre circular plots on each sampling area.

Herbage production and botanical composition were sampled in 20 plots 9.6 sq. ft. in size on each sampling area. Production (ovendry weight) was determined by weight-estimate (Pechanec and Pickford 1937) and composition of yield was estimated by species.

Data were tested by analysis of variance and mean differences were compared by Tukey's test at the $P<0.05$ level (Steel and Torrie 1960).

RESULTS AND DISCUSSION

Overstory

Density.—Overstory density averaged 645 one-inch dbh or greater woody stems per acre (table 1), with no significant differences found among soil groups. Loblolly pine was the most abundant species, averaging 100 to 200 stems per acre on all soils except silty, where pines were not present. Southern red oak also was common and had relatively uniform distribution on all soils. Shortleaf pine, white oak, post oak and hickory occasionally exhibited subdominant roles. Red maple and sweetgum were the most abundant species on silty soil, with an average of 150 and 120 stems per acre, respectively. Other species were generally not abundant on any soil.

Approximately 70 percent of the stems on all soils were less than 5 inches dbh, but most foliage had grown beyond the reach of deer.

Table 1.—*Average density and basal area of trees on all soils*

Species	Density (Stems/acre)[1]	Basal Area (ft^2/acre)
Loblolly pine	132	29.9
Southern red oak	83	13.0
Sweetgum	72	2.7
Post oak	60	5.8
Red maple	55	1.0
Shortleaf pine	36	5.4
White oak	36	4.2
Hickory	32	1.9
Blackgum	28	0.6
Flowering dogwood	24	0.6
Winged elm	23	0.7
Water oak	15	2.7
Blackjack oak	12	1.9
Cherry	8	.3
Eastern hophornbeam	7	.2
American holly	5	.1
Sassafras	4	.1
Common persimmon	4	.1
White ash	2	.1
American elm	2	.1
Hackberry	1	.1
Cherrybark oak	1	.1
American beech	1	.1
Others	2	.0
Total	645	71.7

[1]Includes stems 1-inch dbh and larger.

Basal Area.—Basal area averaged 72 sq. ft. per acre (table 1). Again, total basal area and species basal area differences were nonsignificant among soil groups.

Loblolly and shortleaf pine combined produced 1/2 to 2/3 of the total basal area on all soils except silty, where pines were absent. On silty soil, southern red, white, water and post oaks produced about 90 percent of the total basal areas. Southern red oak and post oak were subdominants on other soils, with hickory, sweetgum, and blackjack oak ranking secondary in importance. Species of lesser importance produced one square foot or less of basal area.

Browse

Density.—Total density of browse species diminished from just over 10,200 stems per acre on the gravelly soil to slightly less than 5,500 on the slowly permeable clayey soil, but differences were nonsignificant. Trees, shrubs, and vines contributed about equal shares to total browse density across all soils (table 2).

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Table 2.—*Average browse density and crown cover on all soils*

Species	Preference by deer[2]	Density (stems/acre)[3]	Crown cover (ft²/acre)
Trees[1]			
Southern red oak	L	494	941
Red maple	M	338a	730a
Sweetgum	L	324	718
Blackgum	M	220	352
Flowering dogwood	M	215	360
Pines	L	175	144
Hickory	L	173	245
White oak	M	101	89
Water oak	M	67	102
Other oaks	L	216	478
Elms	M	91a	99a
Common persimmon	L	72a	150
Cherry	L	70	104
Sassafras	H	58	58
Fringetree	M	21	20
Eastern hophorn-beam	L	17	58
White ash	H	13	21
American hornbeam	L	10	13
American holly	L	5	5
Eastern redcedar	L	5b	4b
Red mulberry	M	4	3
American beech	L	1	1
Black locust	L	1	1
Total trees		2691	4696
Shrubs			
Tree sparkle-berry	L	529	1091
American beautyberry	M	492	1423
Hawthorn	M	245	588
Witch-hazel	L	98	218
Shining sumac	L	269	426b
Elliott blueberry	L	258	240
Rusty blackhaw	M	66	47
St. John's-wort	H	58	46
Southern waxmyrtle	L	44	90
Possumhaw	M	43	36
Red buckeye	L	36	33b
Arrowwood	M	30	79
Bigleaf snowbell	M	27	64
Devils-walkingstick	L	21	47
New Jersey-tea	M	20	16
Carolina buckthorn	L	9	8
Common sweetleaf	M	7	21
Eastern baccharis	L	6b	5b
Yaupon	H	4	7
Pawpaw	M	2	1
Piedmont azalea	M	2	5
Total shrubs		2266	4491
Vines			
Greenbrier	H	849a	—
Poison-ivy	M	742	—
Grape	M	431	—
Blackberry	H	278	—
Carolina jessamine	H	277	—
Virginia creeper	M	127	—
Alabama supplejack	H	58	—
Trumpet-creeper	L	38	—
Crossvine	M	7	—
Japanese honeysuckle	H	6	—
Total vines		2813	—
Total browse		7770	9187

[1]Trees less than 1-inch dbh were classified as browse.

[2]High (H), medium (M), and low (L) preference rating for deer are generally in agreement with Goodrum and Reid (1958), Lay (1967), Halls and Ripley (1961), and Ripley and McClure (1963).

[3]Species followed by the letter "a" differed significantly among soils and had highest values on silty soils. Species followed by "b" had highest values on gravelly soils.

Red maple, sweetgum, blackgum, and oaks were the most abundant tree species qualifying as browse based on stem diameter. Three browse-sized tree species occurred in significantly higher densities on silty soils as opposed to the other soils — red maple (958 vs. 184), elms (267 vs. 47), and common persimmon (208 vs. 38). Eastern redcedar was most abundant on the more droughty gravelly soil.

The most common shrubs were tree sparkleberry, American beautyberry, Elliott blueberry, hawthorn, and shining sumac. Eastern baccharis was more abundant on the gravelly soil than on other soils.

Vines collectively were an important component of total browse density. Poison-ivy was the most common on all soils except silty, where

greenbrier predominated. Greenbrier density was significantly greater on silty soil (1,775) than on other soils (617).

Preference value of browse is highly important to the deer carrying capacity of the site. According to preference ratings established for many of the browse species on southern forest (Goodrum and Reid 1958; Lay 1967; Ripley and McClure 1963; Halls and Ripley 1961), soils in the present study produced 3,300 to 6,000 stems per acre of medium and high preference deer browse. Thus, 60 to 70 percent of the stems were in the medium or high preference categories.

Crown Cover.—Total browse crown cover ranged from 6,000 sq. ft. per acre on very slowly permeable clayey soil to over 13,500 sq. ft. on loamy soil, but differences were not significant.

The proportion of total crown cover contributed by trees and shrubs was approximately equal when averaged across all soils (table 2); however, the crown cover contributed by the two groups varied widely from soil to soil. Trees < 1 inch dbh furnished over 75 percent of the total browse crown cover on silty soil, but less than 30 percent on loamy soil.

Some differences in crown cover are attributed to soils. For example, red maple and winged elm had significantly more crown cover on silty than on any other soil. The only other tree species influenced by soil was Eastern redcedar. Other species fluctuated widely, such as red oak which varied from around 200 sq. ft. per acre on very slowly permeable clayey soil to over 2,500 sq. ft. per acre on gravelly soil, but differences were not significant. Overstory tree density also may have influenced browse crown cover to some extent, but regressions were nonsignificant.

Of the major crown cover producers, tree sparkleberry was the only shrub species that exhibited any degree of uniformity among soils. Shining sumac, red buckeye, and Eastern baccharis were the only shrubs significantly influenced by soil group.

Species with medium and high preference ratings for deer produced over 7,700 sq. ft. of crown cover per acre on loamy soil but only about 2,000 sq. ft. of clayey soils.

Herbage

Total herbage varied significantly, with silty soils producing an average of 180 pounds per acre as compared to 48 pounds on the other soils. Grasses alone produced about 60 to 75 percent of the total herbage on all soils, with grasslikes producing up to 18 percent (table 3). Legumes produced 2 to 8 percent of the total

Table 3.—*Average herbage production on all soils*

Species	Production (lb/acre)
Grasses	
Longleaf uniola	18.4
Low panicums	10.8a[1]
Spike uniola	8.1a
Crabgrass	3.7
Broomsedge bluestem	3.3a
Little bluestem	2.2
Roundseed paspalum	1.6
Big bluestem	1.3
Redtop panicum	.5
Barnyard grass	.3
Brownseed paspalum	.3
Common carpetgrass	.2
Others	.6
Total grasses	51.3
Grasslikes	
Sedges	6.4a
Rushes	.2
Total grasslikes	6.6
Legumes	
Tickclover	1.6
Downy milk pea	.5
Yellow woodsorrel	.4
Partridge pea	.2a
Butterfly pea	.2
Pencilflower	.2
Other legumes	.4
Total legumes	3.5
Other forbs	
Dwarf St. John's-wort	4.6
Stinking pluchea	.9a
Eupatorium	.8
Flowering spurge	.6
Fragrant goldenrod	.4a
Low ruellia	.4
Hairy elephantfoot	.4
Aster	.4a
Bracken fern	.3
Copperleaf	.3
Roughstem rosinweed	.3
Poor-joe	.2
Grassleaf goldaster	.2
Cudweed	.2
Sunflower	.2
Partridge berry	.2
Maryland meadowbeauty	.2
Nettleleaf noseburn	.2
Beebalm horsemint	.2
Other forbs	1.6
Total forbs	12.6
Total herbage	74.0a

[1]Species followed by the letter "a" differed significantly among soils and had highest values on silty soils.

herbage. Other forbs produced 10 to about 20 percent of the herbage.

All soils contained an abundance of species, but many species were uncommon. For example, about 85 species produced less than 0.5 pound per acre, and 50 species produced less than 0.1 pound per acre.

Of the 102 species of herbaceous plants identified, longleaf uniola and spike uniola combined were the largest herbage producers on all soils. These two cool-season grasses are not only shade-tolerant, but they produce more under shade than in full sunlight (Wolters 1974). Low panicums, also considered somewhat shade tolerant, were major herbage producers on all soils. Low panicums, spike uniola, and broomsedge bluestem produced significantly more herbage on silty soil than on other soil groups.

Tickclover was the most productive legume, but it yielded only 1 to 3 pounds per acre. Dwarf St. John's-wort was the highest producing forb, reaching 23 pounds per acre on the silty soil.

Herbaceous species that were significantly influenced by soil group produced the most on silty soils. This may be due to an inherent production capability of the silty soil and the moisture relations of the site, although the absence of pines in the overstory may also have influenced herbage production.

Of the 177 plant species encountered, none were listed as endangered or threatened (Smithsonian Institution 1975).

CONCLUSIONS

Few significant differences occurred in botanical composition among the soils investigated. The most obvious differences occurred on the silty loessial terrace soils that appear to be poorly drained. Here pines were absent and some browse-size trees suggestive of a moist site (red maple, for example) had significant greater densities. Overall, an approximately similar botanical composition can be expected to occur on the soils studied except that the silty soil will show a greater proportion of hardwoods and will likely have greater herbage yields.

The variable management histories experienced by such poorly stocked cutover stands confounds the accurate prediction of botanical composition from soils alone. This is likely to be the case on much of the South's timbered lands subjected to periodic harvest.

However, the mean values found should be broadly representative of much of the vegetation present on West Gulf Coastal Plains timber stands currently being clearcut, site prepared, and planted. This information provides a base for comparing overall forest values after site preparation and regeneration to pine.

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APPENDIX

Appendix Table 4.—*Scientific and common names of trees, shrubs, and vines that occurred on five soil groups in north central Louisiana and south central Arkansas*

Scientific Name	*Common Name*	*Scientific Name*	*Common Name*
Acer rubrum L.	red maple	Lonicera japonica Thunb.	Japanese honeysuckle
Aesculus pavia L.	red buckeye	Morus rubra L.	red mulberry
Anisostichus capreolata (L.) Bureau	crossvine	Myrica cerifera L.	southern waxmyrtle
Aralia spinosa L.	devils-walkingstick	Nyssa sylvatica Marsh.	blackgum
Asiminia triloba (L.) Dunal	pawpaw	Ostrya virginiana (Mill.) K. Koch	eastern hophornbeam
Baccharis halimifolia L.	eastern baccharis	Pinus echinata Mill.	shortleaf pine
Berchemia scandens (Hill) K. Koch	Alabama supplejack	Pinus taeda L.	loblolly pine
Callicarpa americana L.	American beautyberry	Prunus spp.	cherry
Campsis radicans (L.) Seem.	trumpetcreeper	Quercus alba L.	white oak
Carpinus caroliniana Walt.	American hornbeam	Quercus facata Michx.	southern red oak
Carya spp.	hickory	Quercus falcata var. pagodaefolia Ell.	cherrybark oak
Carya tomentosa (Lam.) Nutt.	mockernut hickory	Quercus marilandica Muenchh.	blackjack oak
Carya cordiformis (Wang) K. Koch	bitternut hickory	Quercus muehlenbergii Engelm.	chinkapin oak
Ceanothus americanus L.	New Jersey-tea	Quercus nigra L.	water oak
Celtis laevigata Willd.	hackberry	Quercus stellata Wang.	post oak
Chionanthus virginicus L.	fringetree	Rhamnus caroliniana Walt.	Carolina buckthorn
Cornus florida L.	flowering dogwood	Rhododendron canescens (Michx.) Sweet	Piedmont azalea
Crataegus spp.	hawthorn	Rhus copallina L.	shining sumac
Crataegus marshallii Eggl.	parsley haw	Rhus radicans L.	poison-ivy
Crataegus opaca Hook. & Arn.	mayhaw	Robinia pseudo-acacia L.	black locust
Crataegus pyracanthoides Beadle	pyracantha haw	Rubus spp.	blackberry
Crataegus spathulata Michx.	littlehip haw	Rubus floridus Tratt.	blackberry
Diospyros virginiana L.	common persimmon	Rubus trivialis Michx.	dewberry
Fagus grandifolia Ehrh.	American beech	Sassafras albidum (Nutt.) Nees	sassafras
Fraxinus americana L.	white ash	Smilax spp.	greenbrier
Gelsemium sempervirens (L.) Ait. f.	Carolina jessamine	Smilax bona-nox L.	saw greenbrier
Hamamelis virginiana L.	witch-hazel	Smilax glauca Walt.	cat greenbrier
Hypericum spp.	St. John's-wort	Smilax laurifolia L.	laurel greenbrier
Hypericum hypericoides (L.) Crantz	St. Andrew's cross	Smilax rotundifolia L.	common greenbrier
Hypericum stans (Michx.) P. Adams & Robson	St. Peter's-wort	Styrax grandifolia Ait.	bigleaf snowbell
Ilex decidua Walt.	possumhaw	Symplocos tinctoria (L.) L'Her.	common sweetleaf
Ilex opaca Ait.	American holly	Ulmus alata Michx.	winged elm
Ilex vomitoria Ait.	yaupon	Ulmus americana L.	American elm
Juniperus virginiana L.	eastern redcedar	Vaccinium arboreum Marsh.	tree sparkleberry
Liquidambar styraciflua L.	sweetgum	Vaccinium elliottii Chapm.	Elliott blueberry
		Viburnum dentatum L.	arrowwood
		Virburnum rufidulum Raf.	rusty blackhaw
		Vitis spp.	grape
		Vitis aestivalis Michx.	summer grape
		Vitis rotundifolia Michx.	muscadine grape

Appendix Table 5.—*Scientific and common names of herbaceous plants that occurred on five soil groups in north central Louisiana and south central Arkansas*

Scientific Name	*Common Name*
Acalypha gracilens Gray	copperleaf
Amaranthus retroflexus L.	redroot amaranth
Ambrosia artemisiifolia L.	common ragweed
Andropogon gerardii Vitm.	big bluestem
Andropogon glomeratus (Walt.) BSP.	bushy bluestem
Andropogon scoparius Michx.	little bluestem
Andropogon tener (Nees) Kunth	slender bluestem
Andropogon virginicus L.	broomsedge bluestem
Aristida spp.	threeawn
Arnica spp.	leopards-bane
Asclepias tuberosa L.	butterfly milkweed
Asclepias variegata L.	white milkweed
Aster spp.	aster
Axonopus affinis Chase	common carpetgrass
Baptisia nuttalliana Small	Nuttall wildindigo
Boltonia diffusa Ell.	smallhead boltonia
Carex spp.	sedge
Cassia fasciculata Michx.	partridge pea
Centrosema virginianum (L.) Benth.	butterfly pea
Crotalaria sagittalis L.	arrow crotalaria
Croton capitatus Michx.	wooly croton
Cynodon dactylon (L.) Pers.	Bermudagrass
Desmodium spp.	tickclover
Digitaria spp.	crabgrass
Diodia teres Walt.	poor-joe
Dioscorea villosa L.	Atlantic yam
Echinochloa crusgalli (L.) Beauv.	barnyard grass
Echinocytis lobata (Michx.) T. & G.	wild cucumber
Elephantopus tomentosus L.	hairy elephantfoot
Eragrostis spectabilis (Pursh) Steud.	purple lovegrass
Erigeron canadensis L.	horseweed
Erigeron strigosus Muhl. ex. Willd.	prairie fleabane
Eryngium prostratum Nutt.	creeping eryngo
Eryngium yuccifolium Michx.	button snakeroot
Eupatorium spp.	eupatorium
Euphorbia corollata L.	flowering spurge
Eustylis purpurea (Herb.) Engelm. & Gray	purple pleatleaf
Galactia volubilis (L.) BSP.	downy milkpea
Galium pilosum Ait.	hairy bedstraw
Gnaphalium spathulatum (Lam.) Ahles	cudweed
Gratiola pilosa Michx.	shaggy hedgehyssop
Helianthus spp.	sunflower
Heterotheca graminifolia (Michx.) Shinners	grassleaf goldaster
Hieracium gronovii L.	Gronovius hawkweed
Hypericum mutilum L.	dwarf St. John's-wort
Juncus spp. L.	rush
Lactuca spp.	wild lettuce
Lechea villosa Ell.	hairy pinweed
Lespedeza spp.	lespedeza
Liatris aspera Michx.	rough gayfeather
Liatris elegans (Walt.) Michx.	pinkscale gayfeather
Liatris pycnostachya Michx.	Kansas gayfeather
Linum virginianum L.	woodland flax
Lobelia spicata Lam.	palespike lobelia
Mitchella repens L.	partridge berry
Monarda fistulosa L.	beebalm horsemint
Muhlenbergia expansa (DC.) Trin.	cutover muhly
Oenothera pilosella Raf.	evening primrose
Oxalis stricta L.	yellow woodsorrel
Panicum spp.	low panicums
Panicum agrostoides Spreng.	redtop panicum
Panicum rhizomatum (Hitchc. & Chase.) Fern.	spreading panicum
Paspalum ciliatifolium L.	fringeleaf paspalum
Paspalum circuiare (Nash) Fern.	roundseed paspalum
Paspalum dilatatum Poir.	dallisgrass
Paspalum floridanum Michx.	Florida paspalum
Paspalum plicatulum Michx.	brownseed paspalum
Paspalum urvillei Steud.	vaseygrass
Passiflora lutea L.	yellow passionflower
Phytolacca americana L.	pokeweed
Plantago aristata Michx.	bottlebush plaintain
Pluchea foetida (L.) DC.	stinking pluchea
Podophyllum peltatum L.	common mayapple
Polygonum punctatum Ell	dotted smartweed
Polypremum procumbens L.	juniperleaf
Pteridium aquilinum (L.) Kuhn var. pseudocaudatum (Clute) Heller	bracken fern
Pycnarnhemum tenuifolium Schrad.	slender mountainmint
Pyrrhopappus carolinianus (Walt.) DC.	false dandelion
Rhexia mariana L.	Maryland meadow-beauty
Rhynchosia difformis (Ell.) DC.	hairy rhynchosia
Rhynchosia reniformis DC.	dollarleaf rhynchosia
Rudbeckia grandiflora (Sweet) DC.	rough coneflower
Rudbeckia hirta L.	blackeyed susan
Ruellia humilis Nutt.	low ruellia
Sanicula canadensis L.	Canada sanicle
Schrankia uncinata Willd.	Catclaw sensitivebrier
Scutellaria integrifolia L.	rough skullcap
Silphium asperrimum Hook.	roughstem rosinweed
Solanum carolinense L.	carolina horsenettle
Solidago nitida T. & G.	shiny goldenrod
Solidago odora Ait.	fragrant goldenrod
Solidago rugosa Ait. var. celtidifolia (Small) Fern.	wrinkled goldenrod
Stipa avenacea L.	blackseed needlegrass
Stylosanthes biflora (L.) BSP	pencilflower
Tephrosia virginiana (L.) Pers.	Virginia tephrosia
Tradescantia hirsuticaulis Small	spiderwort
Tragia urticifolia Michx.	nettleleaf noseburn
Uniola laxa (L.) BSP	spike uniola
Uniola sessiliflora Poir.	longleaf uniola
Verbena brasiliensis Velloso	blue verbena
Vernonia angustifolia Michx.	pinebarren ironweed
Viola spp.	violet

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