The Increasing Importance of Vines in Southern Oklahoma

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On the north shore of Lake Texoma, in Marshall County, the area between the lake and the access road to the University of Oklahoma Biological station is becoming overgrown with vines to an obvious extent. Previous papers (Penfound et al., 1965a; Penfound et al., 1965b) have dealt with the vines in certain portions of this area. The present study concerns the entire area for the purpose of determining the plant communities involved with vine growth, the growth rates of the vines and their role in succession, and of ascertaining to what extent vines are increasing.

METHODS

The two-mile stretch between the Station and the bridge across the lake was roughly mapped and compared with aerial photographs made available by the U. S. Department of Conservation, Madill (Fig. 1). Four types of communities were distinguished according to their appearance: willow forest, open fields resulting from abandoned cropland, similar fields in which some woody vegetation is invading, and mixed forest.

In sampling these communities, the point contact method (Crockett, 1964) was used for open field A (Fig. 1, Table II). Ten-meter list quadrats were made in the other fields, including those with some shrubs and trees, called savanna-type fields (Table III). For possible future investigations the quadrat locations are recorded at the Biological Station. Some of the forest areas were analyzed by the arms-length rectangle and variable-radius methods (Rice and Penfound, 1959), but others were practically impenetrable owing to vine growth.

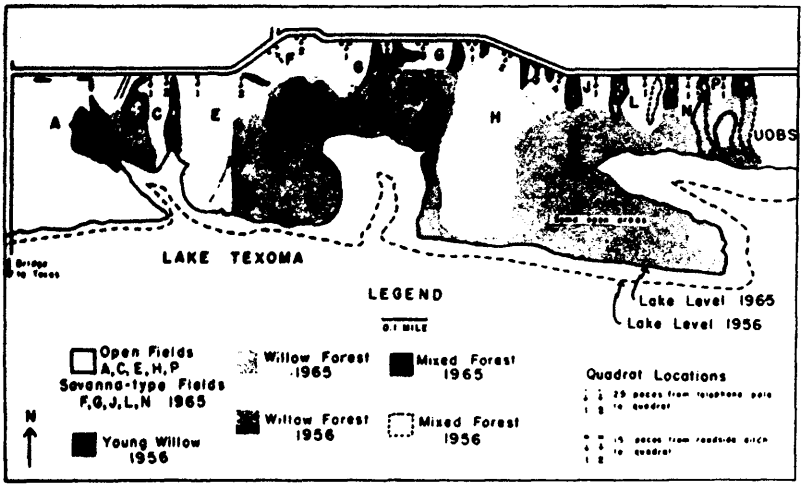

Fig 1 Map of Study Area

Nine species of vines were selected and their growth rates followed over a period of two weeks in the middle of the summer. Four individuals of each species were marked with India ink into a series of 30-cm divisions. Measurements, made nearly every third day, were averaged for each species in the growth curves for this period (Fig. 2). Some trees and shrubs were similarly studied for comparison.

Since the study was carried out during June and July, it necessarily deals primarily with the summer aspect. In order to observe later changes, the area was checked in November.

Results and Discussion

The study area, Fig. 1, slopes gently from the road on the north to the lake shore. The willow forests on the lower portion are partly subjected to inundations with frequent changes of the lake level (Penfound et al., 1965b). Most of the upper part has been under cultivation at some time. The soil, derived from river sand (Bullard, 1926), is well drained here, making possible past crops of cotton and peanuts. These abandoned fields are in various stages of secondary succession. The areas adjacent to the road, marked as mixed forest, have some upland trees.

The center of interest in this study lies in the fact that almost every site designated on the map (Fig. 1) possesses some sort of vine growth. In some cases the vines are sparse, but in others they tend to make a complete cover under or over trees, and over shrubs, grasses and herbaceous forbs.

A total of 67 plants is listed for the area (Table I), as seen in July, with the addition of one herbaceous forb very prominent in the fall, *Chenopodium album*. These are grouped according to growth form in order to more easily associate them with the designated communities.

The willow forest has increased markedly over the small patches of young willows there in 1956 (Fig. 1). The forest, as studied in 1960 (Penfound, 1961), consisted of an almost pure stand of *Salix nigra*, with an average height of 55 ft and an average age of 15 years. In 1965 *Salix nigra* is still the only species with an importance value (average of rela-

tive density, relative frequency, relative basal area) large enough, at 80.9, to be considered a dominant (Rice and Penfound, 1959). Also present are such species as *Acer Negundo, Melia Azederach, Maclura pomifera, Populus deltoides, Ulmus americana, U. rubra,* and *Xanthoxylum Clava-Herculis.*

In 1960 vines were merely mentioned as occurring in the willow forest, with sparse shrubs and heavy herbaceous cover. In 1964, (Penfound, 1965) the herbaceous species were much reduced and the woody species

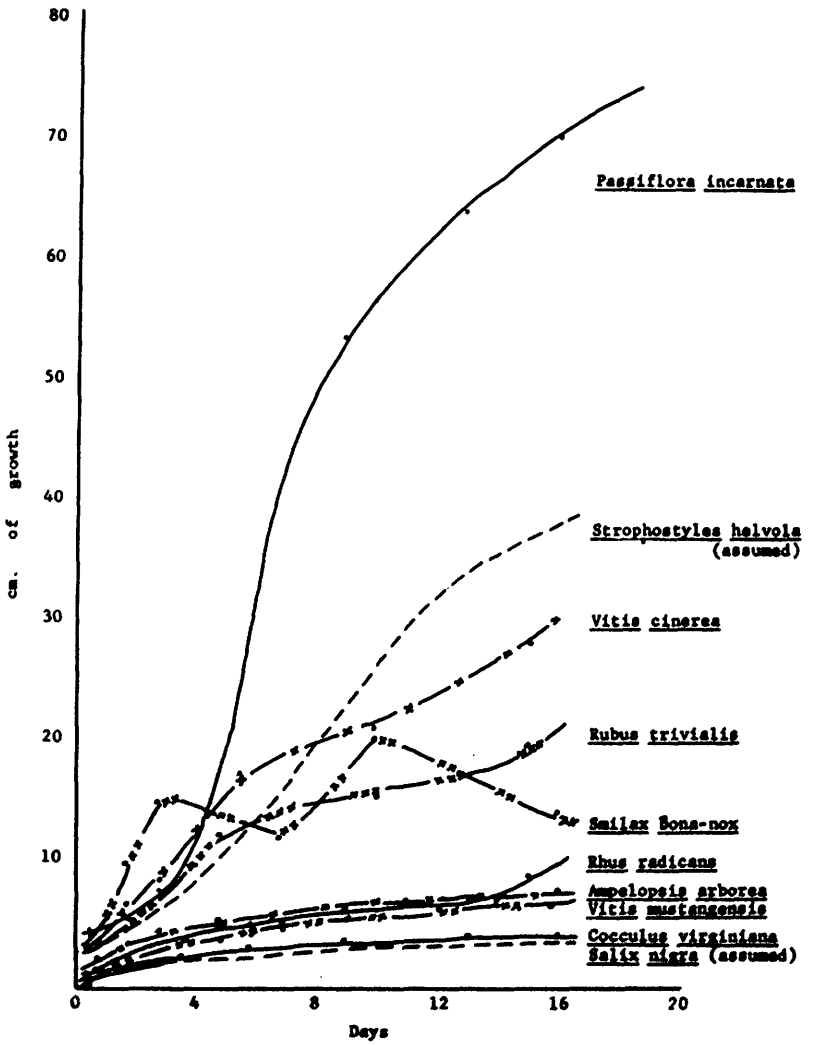

Fig. 2 Growth Rates of Various Vines

had "increased amazingly", making "89.4 percent of the aerial cover of the vegetation on the forest floor." Most of this was due to woody vines (*Rubus* spp., *Rhus radicans, Ampelopsis arborea).* Since these were ascribed to the forest floor, it is assumed that a phenomenal growth of woody vines into and between the tree crowns must have begun this year, for in the summer of 1965 the willow forest, especially the portion south of field F, was literally draped with vines. The dense foliage of *Ampelopsis arborea, Smilax Bona-nox,* and *Vitis cinerea,* high above the ground, increased the shade below, where there was a dense cover of *Rubus* spp. and *Rhus radicans.* In late fall (1965) few vines could be seen where they had been so profuse in the summer. Whether a severe summer windstorm which damaged trees was responsible for this or whether the new shoots do not survive beyond the growing season is a question for further study.

TABLE I. LIST OF PLANTS ACCORDING TO GROWTH FORM[1]

Trees
- Acer Negundo
- Carya texana
- C. illinoensis
- Celtis laevigata
- Cercis canadensis
- Diospyros virginiana
- Fraxinus americana
- Juniperus virginiana
- Maclura pomifera
- Melia Azederach
- Morus rubra
- Populus deltoides
- Quercus marilandica
- Q. stellata
- Salix nigra
- Ulmus alata
- U. crassifolia
- U. americana
- U. rubra
- Xanthoxylum Clava-Herculis

Shrubs
- Cephalanthus occidentalis
- Prunus angustifolia
- Rhus glabra
- Symphoricarpos orbiculatus

Vines (and trailing shrubs)
- Ampelopsis arborea
- A. cordata
- Cocculus carolinus
- Galactia volubilis var. mississippiensis
- Parthenocissus quinquefolia
- Passiflora incarnata
- Rhus radicans
- Rhynchosia latifolia
- Rosa setigera
- Rubus trivialis
- Smilax Bona-nox
- S. rotundifolia

Vines (continued)
- Strophostyles helvola
- Vitis cinerea
- V. mustangensis

Grasses
- Andropogon saccharoides
- A. scoparius
- A. virginicus
- Bouteloua curtipendula
- Bromus tectorum
- Cenchrus pauciflorus
- Cynodon dactylon
- Panicum virgatum
- Poa annua
- Sorghastrum nutans
- Sorghum halepense

Herbaceous forbs
- Ambrosia psilostachya
- Aphanostephus skirrhobasis
- Apocynum cannabinum
- Cassia fasciculata
- Chenopodium album
- Cnidosculus texanus
- Conyza canadensis
- Cyperus ovularis var. cylindricus
- Gaillardia pulchella
- Gaura parviflora
- Heterotheca latifolia
- Lespedeza Stuevei
- Lippia incisa
- Melilotus alba
- Monarda punctata var. villicaulis
- Phytolacca americana
- Plantago Purshii
- Rudbeckia hirta var. pulcherrima
- Solanum carolinense

[1]Nomenclature according to Waterfall, Keys to the Flora of Oklahoma, 1962. (Most varietal epithets arbitrarily omitted).

The upper part of the area, consisting of alternating open fields and small stands of trees, also contains dense growths of vines. In field A the point contact method of analysis shows a large proportion of Johnson grass, *Sorghum halepense,* and a heterogeneous aggregation of other grasses and forbs, indicating recent cultivation. The summary of quadrat sampling in the other fields (Table III) shows a sequence of increasingly longer times since cultivation, from field C to where climax prairie grasses are being invaded by shrubs and trees, in the fields to the west (Fig. 1).

The Johnson grass field just mentioned was noted in 1964 (Penfound et al., 1965a) as being invaded and partly overgrown by the leguminous vine, *Strophostyles helvola.* The short-line method of analysis then used counts aerial parts above and below the line. This method, devised for this type of vegetation, probably gives better values for vines, since counting only basal contacts, as in this study, gave a very low value for this species. It should be noted, however, that in late November there was no evidence of the climbing bean, probably owing to its being herbaceous, but the Johnson grass was still erect in parts of the field. It is possible that any dominance of the vine is, therefore, only seasonal. The most conspicuous plant at that time was *Chenopodium album,* which was still green and flourishing. Probably more study should be given to this area in other parts of the year.

The quadrat analyses of all the fields except A show the importance of certain herbaceous forbs, at least in mid-summer. *Monarda* and *Ambrosia* were recorded in more plots than any others (frequency), but *Monarda,* in spite of its prominence when in flower, did not show the density of *Ambrosia* and *Cassia.* The variation recorded in the different fields confirms the observation that the dominants vary locally within the area.

Fields E, F, G, and H, with the largest counts of herbaceous forbs, also tallied more vines than the other fields. Masses of vines exist here, either prostrate or forming mounds over supporting plants such as tall herbs or single, small junipers, persimmons, etc. The late fall aspect here revealed intact mounds of vine stems without leaves but with fruits, whereas in field C, *Smilax* could be found only as short shoots under dead herbs.

TABLE II. POINT CONTACT ANALYSIS OF OPFN FIELD A.

Number of points 1510	Percentage composition
Bare ground	71.00
Sorghum halepense	8.23
Heterotheca latifolia	3.97
Poa annua	2.51
Ambrosia psilostachya	1.52
STROPHOSTYLES HELVOLA*	1.19
14 species of grasses and herbaceous forbs, each less than 1%	11.00

*The names of vines capitalized for emphasis

The small patches of trees near the road, designated mixed forest (Fig. 1) consist largely of *Maclura pomifera, Quercus marilandica,* and *Ulmus crassifolia,* a few willows, cottonwoods and the other trees of Table I not already listed for the willow forest. Some of these trees are completely covered with vines, making dense thickets. The only trees observed to be without vines are cottonwoods and oaks.

TABLE III. SUMMARY OF QUADRAT DATA IN OPEN FIELDS

Field No. quads (17)	C 2	E 2	F 2	G 3	H 4	I 1	J 1	N 1	P 1	Total indiv.	Dens.	Freq. (%)
Ambrosia psil.	33	13	15	85	35				10	191	11.23	70.58
Conyza canad.	32			15	15			5		67	3.92	41.17
Heterotheca lat.	30			20	5	20				75	4.41	29.23
Cassia fasc.	15	160	25	15	45	5				265	15.59	64.70
Monarda punc.	15	10	40	25	40	5				135	7.92	82.35
Lespedeza St.	13			25	80	10	5	10	10	153	8.98	64.70
Bromus tect.	8		50	35	10	10		10		123	7.28	52.35
Rudbeckia hir.	7	10	10	20					10	62	3.64	64.70
SMILAX BON.*	5	5	35	30	20		10			105	6.20	35.29
Juniperus vir.		2	5	5	15					27	1.58	29.23
Solanum car.			10	5	20		5			40	2.35	41.17
AMPELOPSIS ARB.					25					25	1.47	11.76
RUBUS TRIV.					20					20	1.17	5.88
RHUS RAD.					15					15	0.88	5.88
Ulmus alata					5	5	25	5		40	2.35	23.52
Andropon scop.						30	60	65	15	170	10.00	23.52

*The names of vines capitalized for emphasis

The prominence of vines raises the question of their seed dispersal and original introduction. Of the 15 vines and trailing shrubs listed, all have fleshy fruits except the climbing bean, *Strophostyles helvola,* and the other two legumes, *Galactia volubilis var. mississippiensis* and *Rhynchosia latifolia.* The circling of deciduous trees by vine stems as well as by young junipers suggests birds as frequent carriers in both cases. In late fall the dark-colored fruits of *Smilax, Ampelopsis,* and *Vitis* are evident.

Growth measurements recorded over 2 weeks in July showed a great difference between vines and trees (Fig. 2). The slight slope in the broken curve for *Salix,* called assumed, is actually a summary of the slow growth rates of several shrubs and trees measured. Willow twigs were among the few found to be still elongating in midsummer. These records compare favorably with summer growth of *Salix, Carya* and *Celtis* in Louisiana (Bonck and Penfound, 1944), in that, when averaged and correlated to a 2-week period, the growth of the trees would be 2 to 6 cm. The vines in this study, however, grew from 4 to 70 cm in the same unit of time. The greatest elongation of some of these must be either before or after the period of measurement, but it can be said in general that rapid stem elongation during the summer when trees and shrubs grow slowly probably explains how vines can "outgrow" other plants and cover supporting vegetation. It would be of value to know how long this continues and to correlate growth with rainfall and soil moisture. The flattening and later upswinging of some of the curves (Fig. 2) might be due to dry weather in the middle of the 2-week period. Some difficulty was encountered due to phytophagous insects which ate terminal buds of *Strophostyles* and *Smilax.* The broken line for the former indicates the less clear-cut growth rate for these vines. The other species showed no damage by insects.

It is thought that some vines may continue growing into the fall. In late November a heavy mass of grape vines covering low shrubs appeared dead or dormant, but growing out of it were fresh stems many yards in length, with green leaves and young tendrils. These stems had grown to and twined around and over a small juniper several feet away. They may have grown after the fall rains. If they survive the winter, the grape vine will have a head start next year in covering the slow-growing juniper.

What role do vines play in succession on the north shore of Lake Texoma? It seems obvious that the land in question is succeeding to bottomland forest on the lower part and to upland forest on the higher portion (upland forest exists, where not removed, on the other side of the road). Vines may well fill more than one niche in this complexity. They form an undercover and partial top cover in established willow forests. Whether the vine growth kills the already mature willows, or not, this heavy vegetation may limit the next stage to shade-tolerant plants instead of the shade-intolerant, long-enduring cottonwoods which often follow willows. This, it seems, would have the ultimate effect of accelerating the succession. In the higher ground tree groups, converted into impenetrable masses, it is difficult to see beyond the destructive effect of the vines, but as oaks increase in numbers, the vines will become less important.

In the revegetation of abandoned fields, the vine communities have been called intermediate stages between early grass or herbgrass and later tree stages consisting of willows where wet and persimmon-elm where moist (Penfound et al., 1965b). If cottonwoods were to become a later stage after the willows, the climbers should be reduced as they would be eventually in upland forests, since the cottonwoods and oaks do not offer favorable habitats for vines. The prevalence of the intermediate vines

may well delay the later stages, for the vines, once established, can quickly take over an individual plant or can dominate a whole community.

The diverse roles of vines may be due in part to the adaptability of some. *Smilax Bona-nox,* for example, has been observed to be crowded out by grasses, to overgrow and destroy medium sized shrubs and trees, and also to live quite well in the lower branches of large willows. Grape vines occur more often in bottomland forest, but have formed large masses on other plants in the open. *Ampelopsis arborea* may trail almost horizontally near the ground or climb to the tops of trees. Any one of these would be suitable for an autecological study.

It seems evident that vines are becoming increasingly important in southern Oklahoma, at least near Lake Texoma. The *Smilax-Rubus* community, the discovery of which is credited to Rice in 1952, increased to 14.2 acres in only 2 years (Penfound et al., 1965b). The proximity of a large body of water may provide enough humidity to favor rapid growth, since the effect of the lake is known to be felt for 400 to 660 yards on the north side (Rice, 1952). Not only are the already established vines increasing, but newly abandoned fields are adding potential habitats. It has also been found that the present practice of killing trees by spraying is opening areas to secondary succession where vines develop rapidly (David Brown, personal communication, 1965). If not killed by respraying, these vines may play still another role in succession.

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