Figure 1a. General relationship of upland forest types to the base-related gradient (left to right), and to mesic versus xeric conditions (lower to upper). The typical gradient in hilly landscapes from mesic to xeric conditions (Classes 05 to 11 to 12) is similar to that on deeper soils in farmed landscapes, from forest to thickets to open woodland and old fields (Classes 07 to 08 to 10); see text for differences and further explanation.

<table>
<tr><td>XERIC &
SERAL SITES

Class 12 (+10)</td><td colspan="2">Virginia pine
HARD PINE
pitch pine
shortleaf pine</td><td colspan="2">redbud
RED CEDAR
apple, haw, plum
honey locust</td></tr>
<tr><td>narrow ridges,
southwest
slopes

SUBXERIC
SITES

Class 11 (+08)</td><td>scarlet oak
chestnut oak

OAK-CHESTNUT

(white pine)
sourwood</td><td colspan="2">sassafras, persimmon
black oak, white oak

OAK-HICKORY

black gum
red maple
black locust
black cherry</td><td>shumard oak
chinquapin oak

OAK-ASH

(yellowood)
elm</td></tr>
<tr><td>MESIC SITES

northeast
slopes,
well-drained
bottoms

Class 05 (+07)</td><td>birch
magnolia

HEMLOCK
(more common in the Appalachians)</td><td>sweetgum
tulip poplar

BEECH
(widespread in eastern states)</td><td>walnut
basswood

SUGAR MAPLE
(more common in the mid-west)</td><td>coffee tree
hackberry

BUCKEYE
(locally associated with ungulates)</td></tr>
<tr><td>NUTRIENT
STATUS</td><td>pH ca. 4.0
nutrient-poor soil
typically on sandstone</td><td colspan="2">pH ca. 5.5
average soils on various
parent materials</td><td>pH ca. 7.0
nutrient-rich soil
typically on limestone</td></tr>
</table>

Figure 2b. Trends in ground cover of mature stands on Daniel Boone National Forest along major compositional gradients: base-related (low to high fertility) and water-related (mesic to xeric).

Water-related gradient division	**Base-related gradient division**				
	A: low (hemlock, chestnut oak, etc.)	B: low-moderate (transitions)	C: moderate (beech, white oak, etc.)	D: moderate-high (transitions)	E: high (sugarmaple, chinquapin oak, etc.)
Xeric (pine, cedar)	**1(4.5)**	**1(5)**	**1.5**	**??**	**3.5?**
Xeric-subxeric (transition)	**1.5(?)**	**1.5(4.5)**	**2(?)**	**??**	**??**
Subxeric (oaks, hickories, etc.)	**1(4)**	**2(4)**	**2.5(4.5)**	**3.5**	**3?**
Subxeric-mesic (transition)	**1.5(4)**	**2.5**	**4**	**3.5**	**4**
Mesic-subxeric (transition)	**1**	**2.5**	**3**	**4**	**4.5?**
Mesic: colluvial (sugar, beech, etc.)	**1**	**3.5**	**3.5**	**4.5**	**5?**
Mesic: alluvial-riparian transition	**2**	**3**	**4**	**4**	**??**

Explanation. In 1993-95, J. Campbell, M. Hines & D. Taylor surveyed 500+ plots of 10 m radius along transects chosen to represent the full range of soil conditions on DBNF. Displayed values are medians. Units are quasi-logarithmic: 1 = 0-1%; 2 = 1-2%; 3 = 2-5%; 4= 5-10%; 5= 10-20%; ? indicates < 5 plots; ?? indicates no data yet available. Cover is defined as total leaf area (from horizontal to vertical and including overlaps) of herbaceous species, including graminoids and prostrate phases of woody vines, all visually estimated as percentages of plot area. Excluded are subshrubs (woody species less than 0.3 m tall), which are mostly Ericaceae; *but these subshrub covers are in parentheses*. Data come from mature forest only, typified by sugar maple, beech, hemlock, oaks, hickories & (on xeric sites) pines or cedar; reports to DBNF provides detailed descriptions of each forest type.

Figure 2a. Diagram showing general relationships between vegetation, hydrology, topography and disturbance.

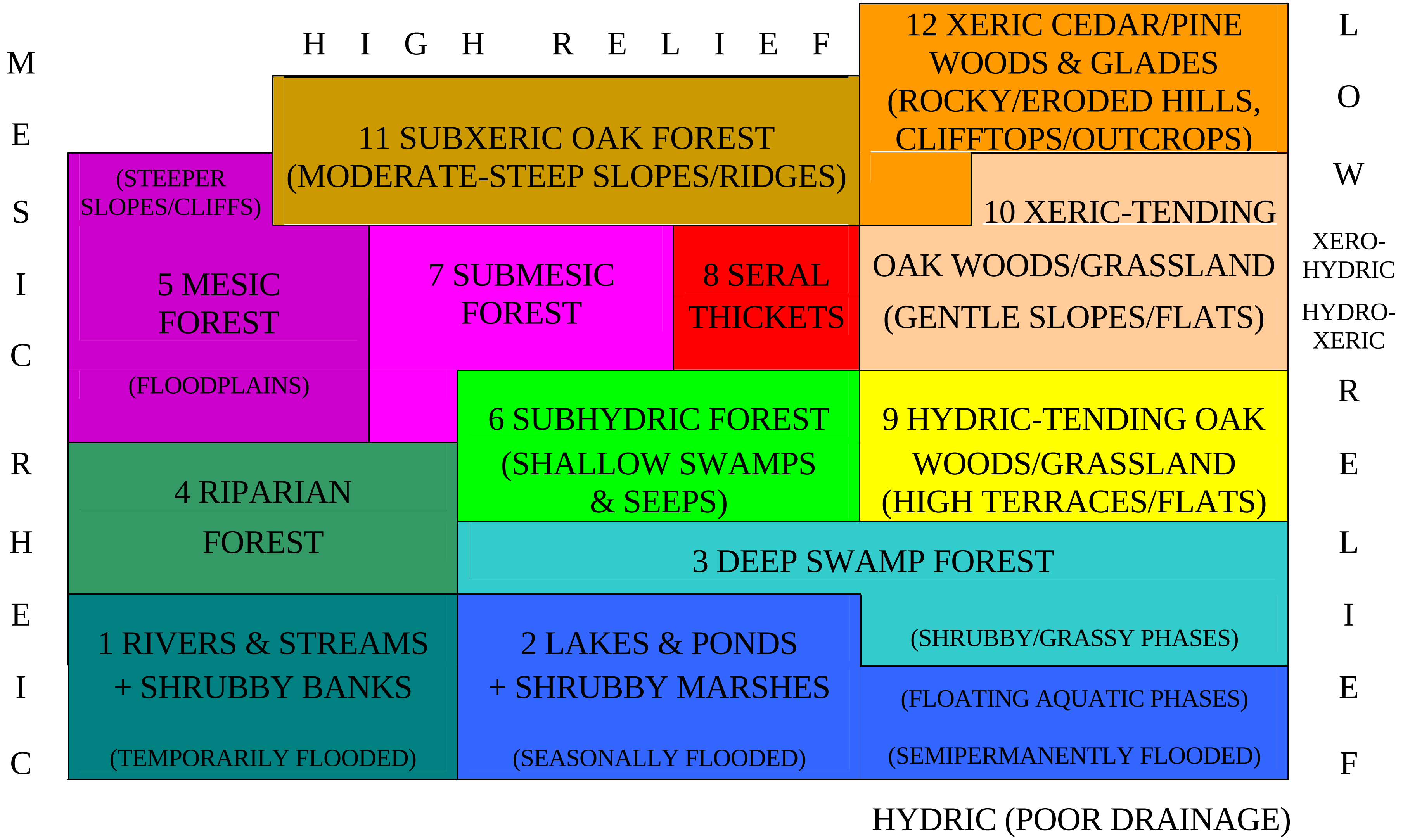
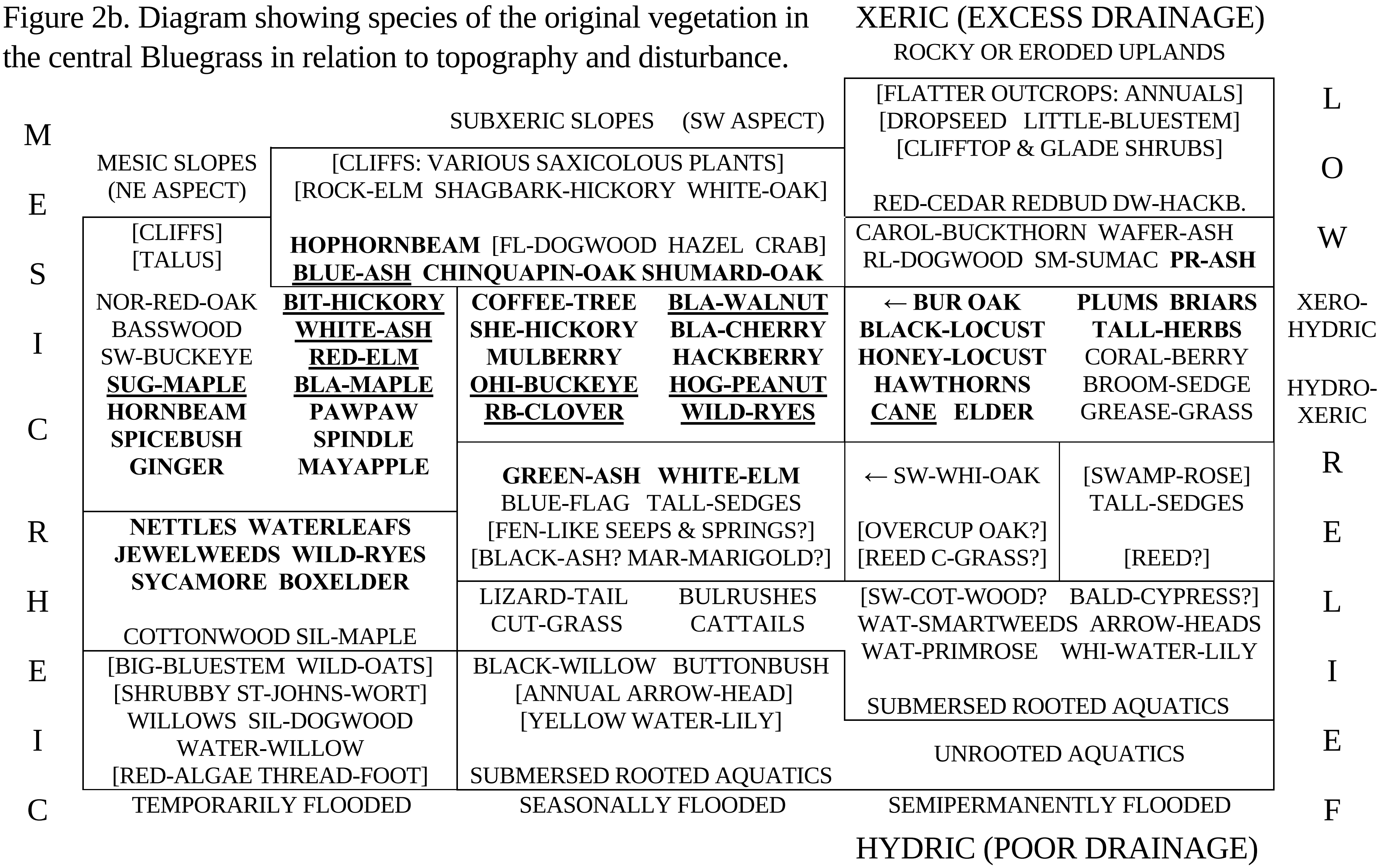


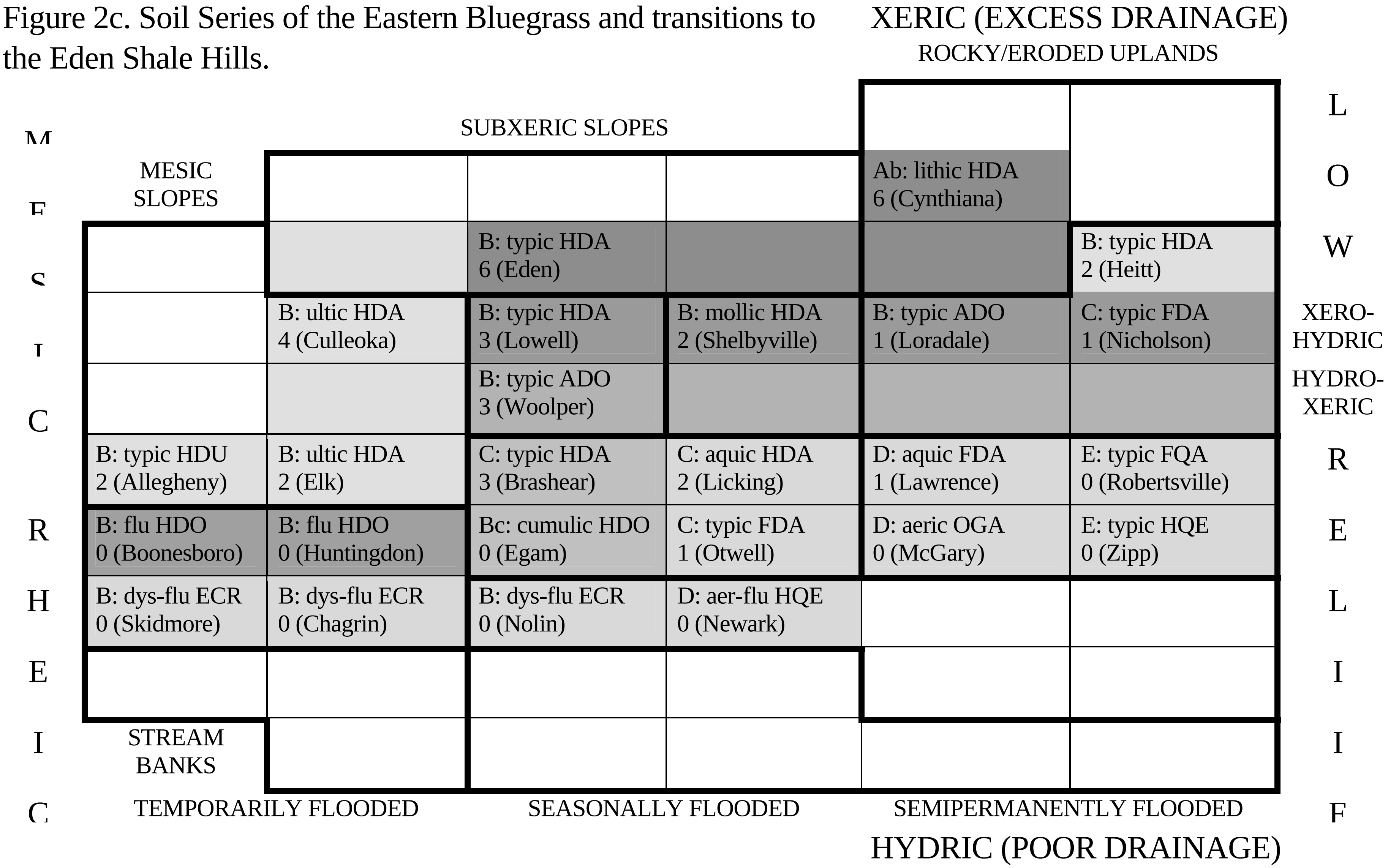
Figure 1. Diagram showing general relationship of habitat classes to hydrology. Cliffs and other rocky openings occur on the upper side; aquatic openings occur on the lower side. Between these extremes, more open, stressed or disturbed vegetation tends to occur to the right, but there are exceptions. See text for further details.

Figure 2b. Diagram showing species of the original vegetation in the central Bluegrass in relation to topography and disturbance.



*Species in bold were common across the region; underlined were locally abundant; species in brackets were largely restricted to peripheral hills and other special habitats. Some names need further explanation: “nettles” indicate Urticaceae in general; “waterleafs” indicate Hydrophyllaceae in general.

Figure 2c. Soil Series of the Eastern Bluegrass and transitions to the Eden Shale Hills.



XERIC (EXCESS DRAINAGE)

ROCKY/ERODED UPLANDS

SUBXERIC SLOPES

M							L
E	MESIC SLOPES				Ab: lithic HDA 6 (Cynthiana)		O
S			B: typic HDA 6 (Eden)			B: typic HDA 2 (Heitt)	W
I		B: ultic HDA 4 (Culleoka)	B: typic HDA 3 (Lowell)	B: mollic HDA 2 (Shelbyville)	B: typic ADO 1 (Loradale)	C: typic FDA 1 (Nicholson)	XERO-HYDRIC
C			B: typic ADO 3 (Woolper)				HYDRO-XERIC
	B: typic HDU 2 (Allegheny)	B: ultic HDA 2 (Elk)	C: typic HDA 3 (Brashear)	C: aquic HDA 2 (Licking)	D: aquic FDA 1 (Lawrence)	E: typic FQA 0 (Robertsville)	R
R	B: flu HDO 0 (Boonesboro)	B: flu HDO 0 (Huntingdon)	Bc: cumulic HDO 0 (Egam)	C: typic FDA 1 (Otwell)	D: aeric OGA 0 (McGary)	E: typic HQE 0 (Zipp)	E
H	B: dys-flu ECR 0 (Skidmore)	B: dys-flu ECR 0 (Chagrin)	B: dys-flu ECR 0 (Nolin)	D: aer-flu HQE 0 (Newark)			L
E							I
I	STREAM BANKS						I
C	TEMPORARILY FLOODED		SEASONALLY FLOODED		SEMIPERMANENTLY FLOODED		F

HYDRIC (POOR DRAINAGE)

* Brief explanation: xeric = dry enough to maintain open woods with red cedar, scrub pine or shrubs; subxeric = moderate, dry enough for oak dominance with little disturbance; xerohydric = with alternating dry summers/falls and wet winters/springs; submesic = intermediate conditions between mesic, xeric and hydric; mesic = with low enough stress to maintain sugar maple, beech or hemlock dominance; subhydric = somewhat poorly drained; hydric = poorly drained (anaerobic subsoils); riparian = generally well drained but floodplain.

Figure 2d. Generalized summary diagram showing relationship to flooding and hydric conditions*.

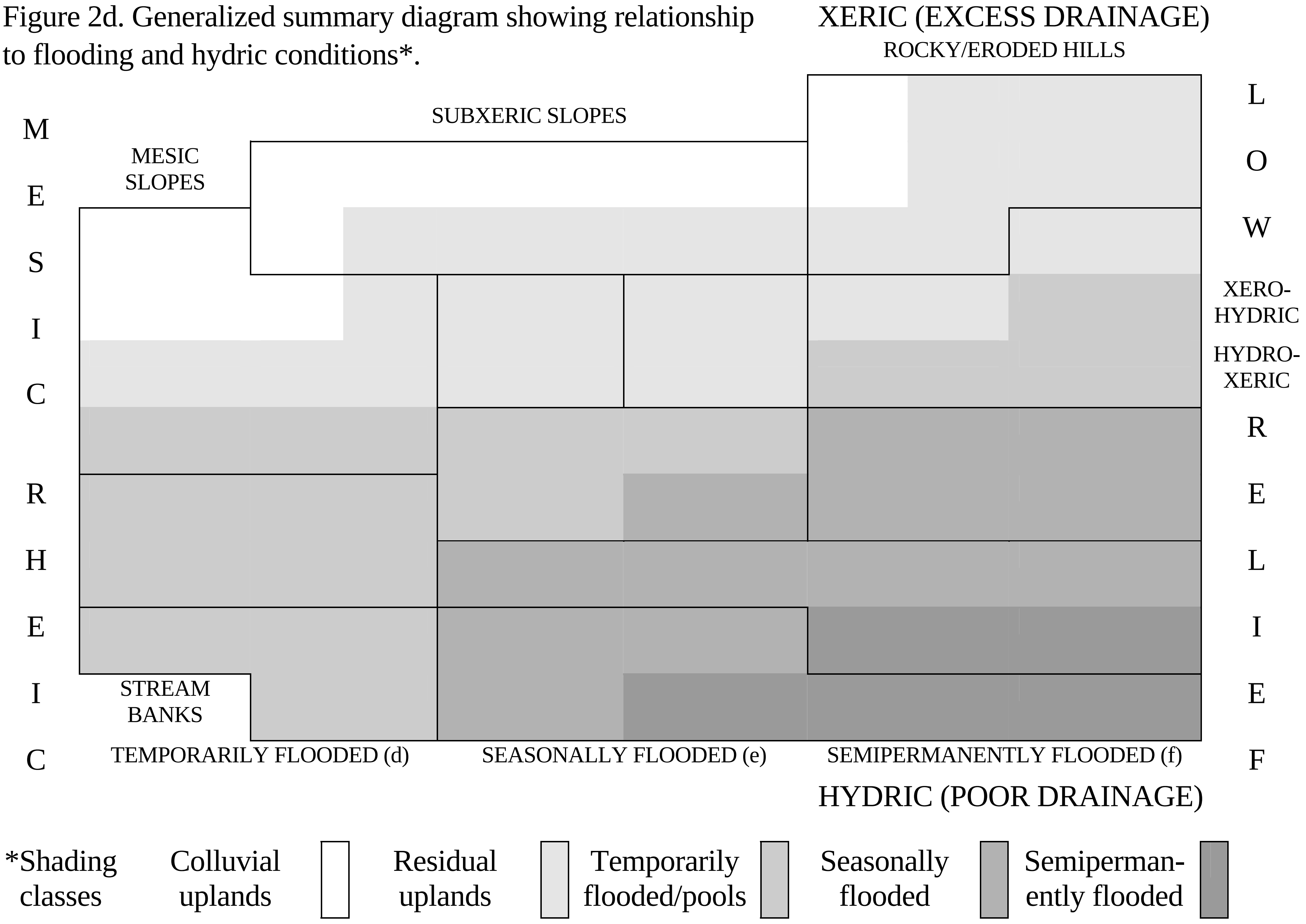
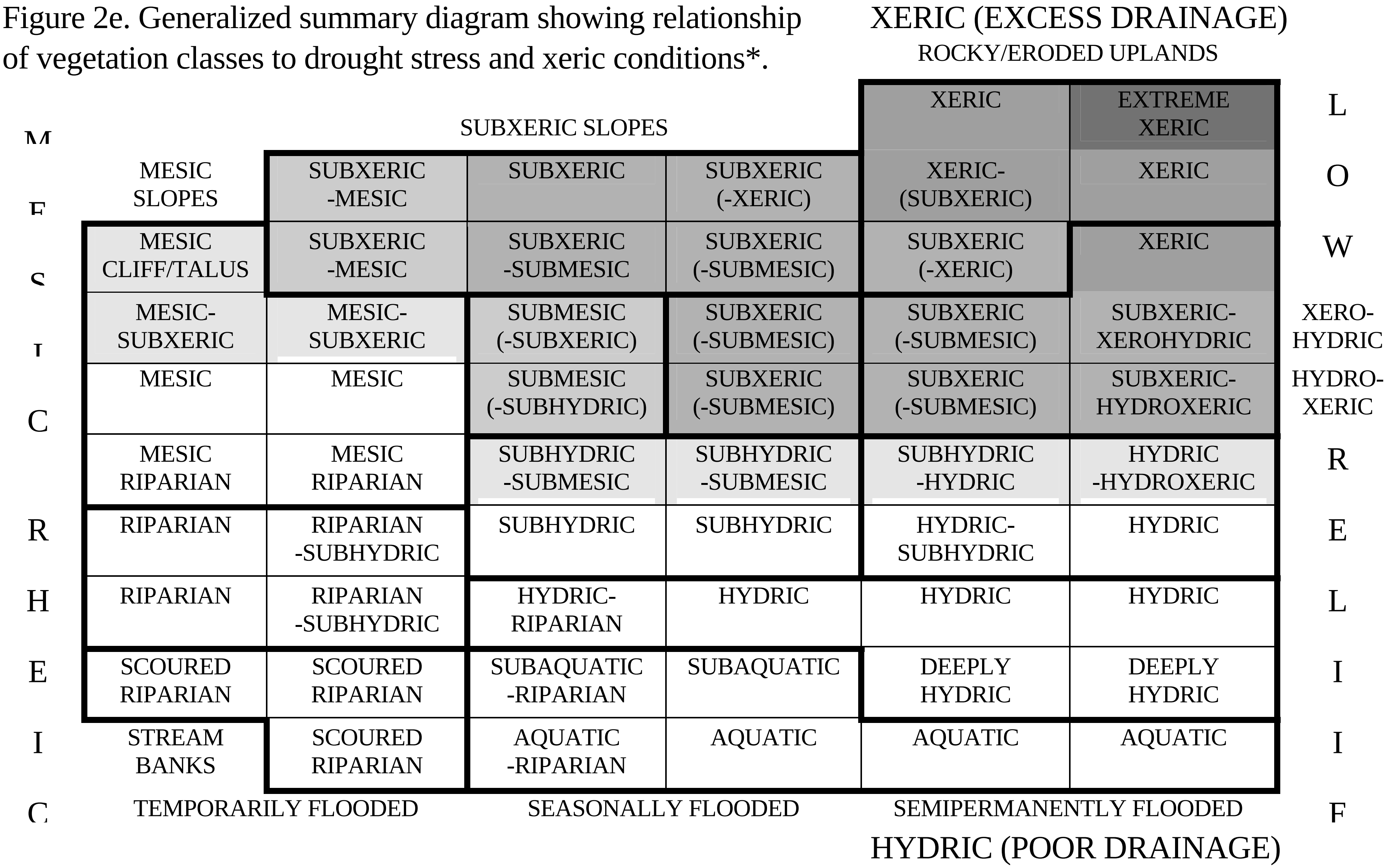


Figure 2e. Generalized summary diagram showing relationship of vegetation classes to drought stress and xeric conditions*.



XERIC (EXCESS DRAINAGE)

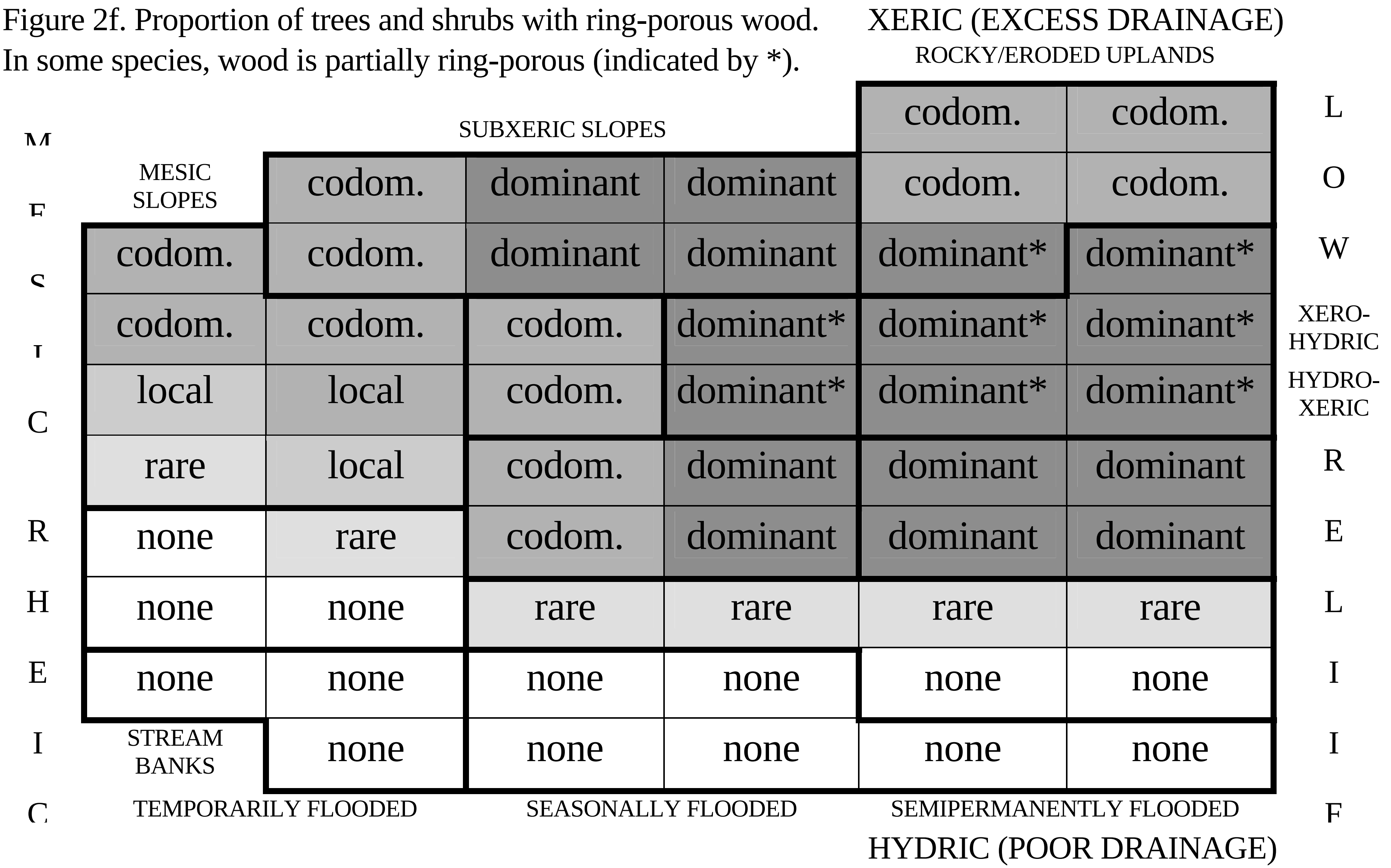
ROCKY/ERODED UPLANDS

M		SUBXERIC SLOPES			XERIC	EXTREME XERIC	L
E	MESIC SLOPES	SUBXERIC-MESIC	SUBXERIC	SUBXERIC (-XERIC)	XERIC-(SUBXERIC)	XERIC	O
S	MESIC CLIFF/TALUS	SUBXERIC-MESIC	SUBXERIC-SUBMESIC	SUBXERIC (-SUBMESIC)	SUBXERIC (-XERIC)	XERIC	W
I	MESIC-SUBXERIC	MESIC-SUBXERIC	SUBMESIC (-SUBXERIC)	SUBXERIC (-SUBMESIC)	SUBXERIC (-SUBMESIC)	SUBXERIC-XEROHYDRIC	XERO-HYDRIC
C	MESIC	MESIC	SUBMESIC (-SUBHYDRIC)	SUBXERIC (-SUBMESIC)	SUBXERIC (-SUBMESIC)	SUBXERIC-HYDROXERIC	HYDRO-XERIC
	MESIC RIPARIAN	MESIC RIPARIAN	SUBHYDRIC-SUBMESIC	SUBHYDRIC-SUBMESIC	SUBHYDRIC-HYDRIC	HYDRIC-HYDROXERIC	R
R	RIPARIAN	RIPARIAN-SUBHYDRIC	SUBHYDRIC	SUBHYDRIC	HYDRIC-SUBHYDRIC	HYDRIC	E
H	RIPARIAN	RIPARIAN-SUBHYDRIC	HYDRIC-RIPARIAN	HYDRIC	HYDRIC	HYDRIC	L
E	SCOURED RIPARIAN	SCOURED RIPARIAN	SUBAQUATIC-RIPARIAN	SUBAQUATIC	DEEPLY HYDRIC	DEEPLY HYDRIC	I
I	STREAM BANKS	SCOURED RIPARIAN	AQUATIC-RIPARIAN	AQUATIC	AQUATIC	AQUATIC	I
C	TEMPORARILY FLOODED		SEASONALLY FLOODED		SEMIPERMANENTLY FLOODED		F

HYDRIC (POOR DRAINAGE)

* Brief explanation: xeric = dry enough to maintain open woods with red cedar, scrub pine or shrubs; subxeric = moderate, dry enough for oak dominance with little disturbance; xerohydric = with alternating dry summers/falls and wet winters/springs; submesic = intermediate conditions between mesic, xeric and hydric; mesic = with low enough stress to maintain sugar maple, beech or hemlock dominance; subhydric = somewhat poorly drained; hydric = poorly drained (anaerobic subsoils); riparian = generally well drained but floodplain.

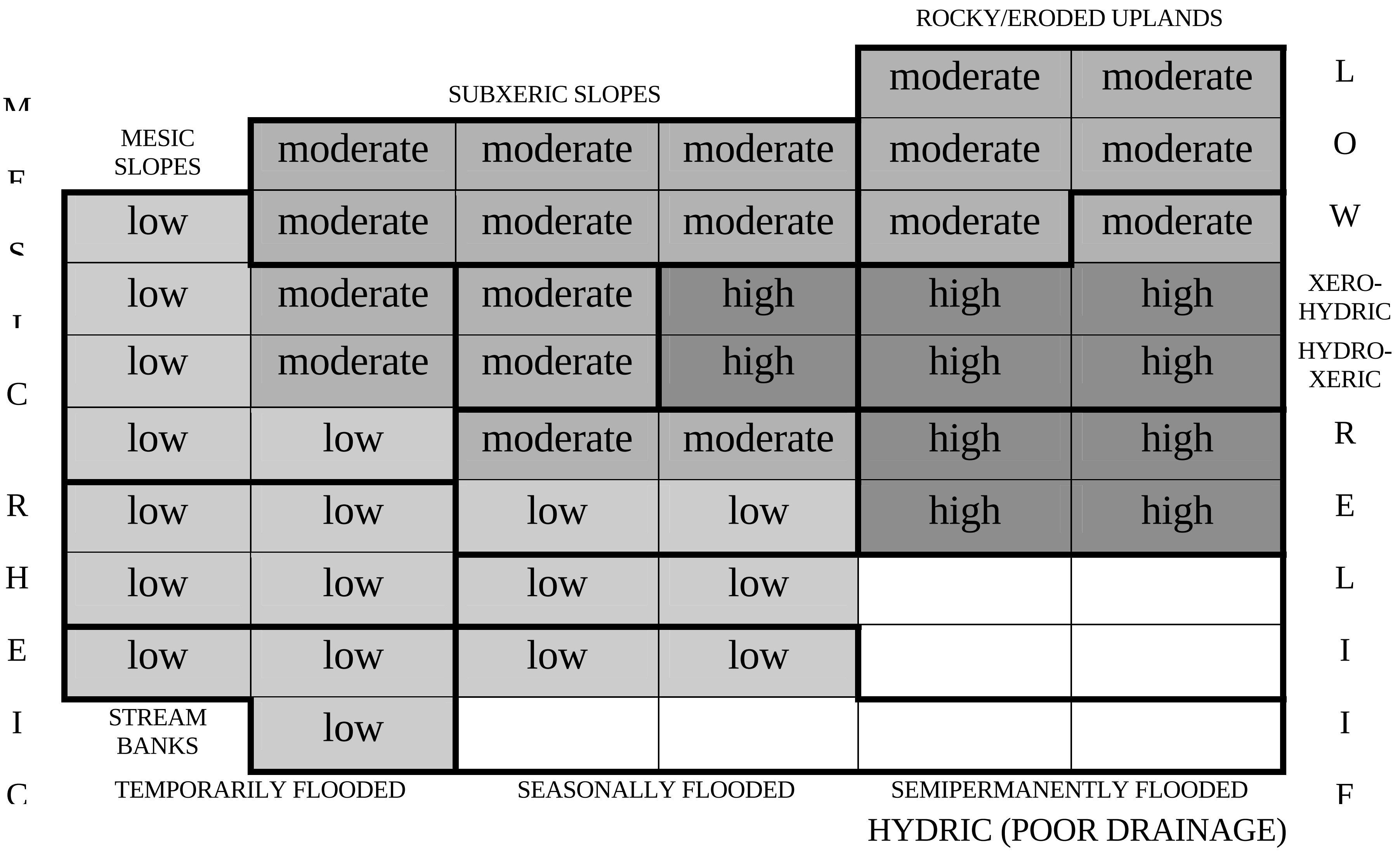
Figure 2f. Proportion of trees and shrubs with ring-porous wood. In some species, wood is partially ring-porous (indicated by *).



				codom.	codom.
	codom.	dominant	dominant	codom.	codom.
codom.	codom.	dominant	dominant	dominant*	dominant*
codom.	codom.	codom.	dominant*	dominant*	dominant*
local	local	codom.	dominant*	dominant*	dominant*
rare	local	codom.	dominant	dominant	dominant
none	rare	codom.	dominant	dominant	dominant
none	none	rare	rare	rare	rare
none	none	none	none	none	none
	none	none	none	none	none

* Estimated levels of significant effects before settlement: strong = much land burned with effects at ca. 1-5 year intervals; moderate = most land burned with effects at ca.. 5-50 year intervals; weak = most land burned with effects at ca. 50-100+ intervals; rare = most land not influenced by fire; none = no land influenced by fire.

Figure 2g. Proportion of trees and shrubs with hairy leaves.

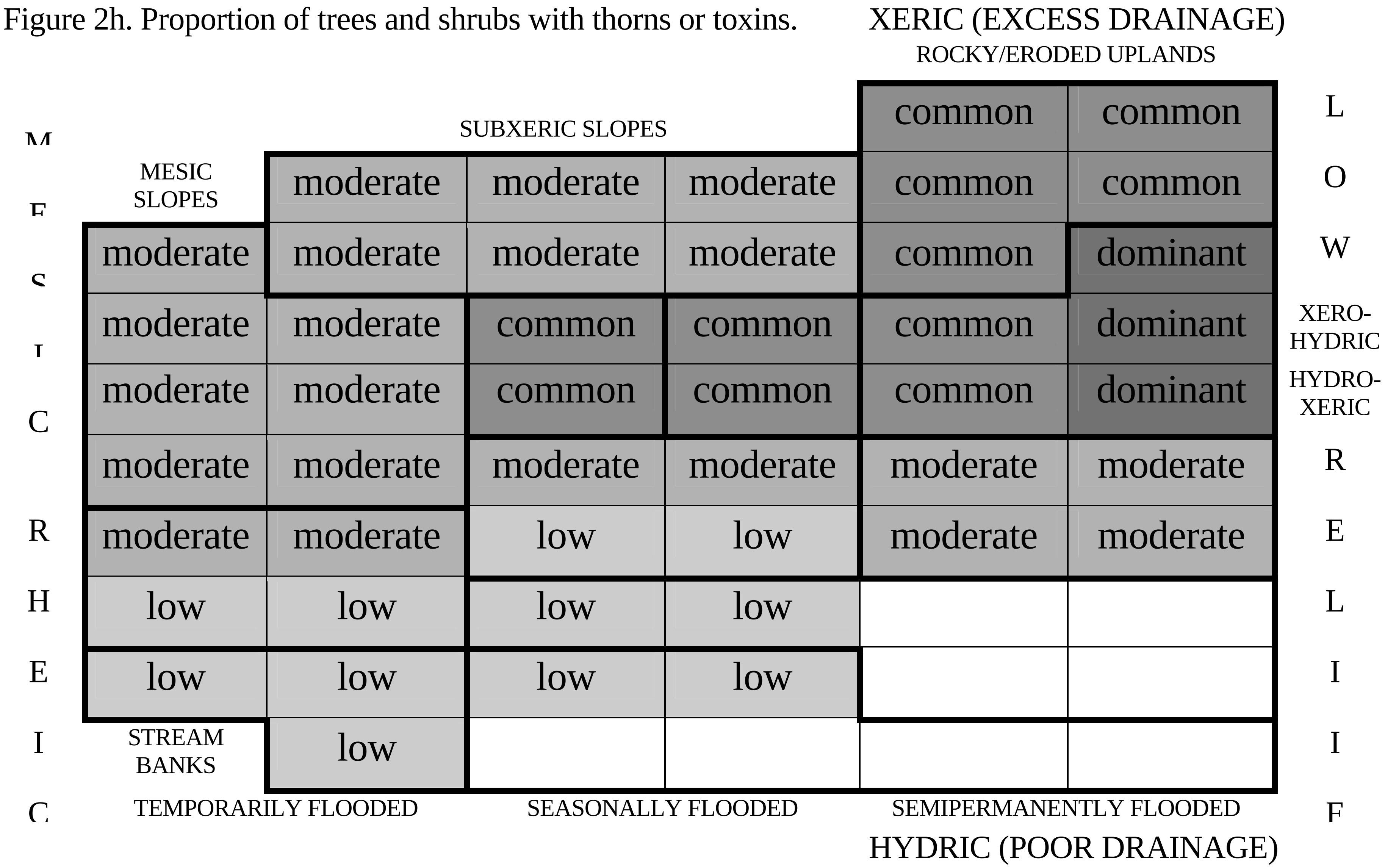


				moderate	moderate
MESIC SLOPES	moderate	moderate	moderate	moderate	moderate
low	moderate	moderate	moderate	moderate	moderate
low	moderate	moderate	high	high	high
low	moderate	moderate	high	high	high
low	low	moderate	moderate	high	high
low	low	low	low	high	high
low	low	low	low		
low	low	low	low		
STREAM BANKS	low				

*

Species with densely hairy leaves include walnut, hickories, hackberry, elms, some oaks, hophornbeam, roughleaf dogwood, downy hawthorn, most briars, most plums; species with less dense hairs or variable conditions include basswoods, buckeyes, black maple, white ash, other dogwoods. Other are glabrous or usually so.

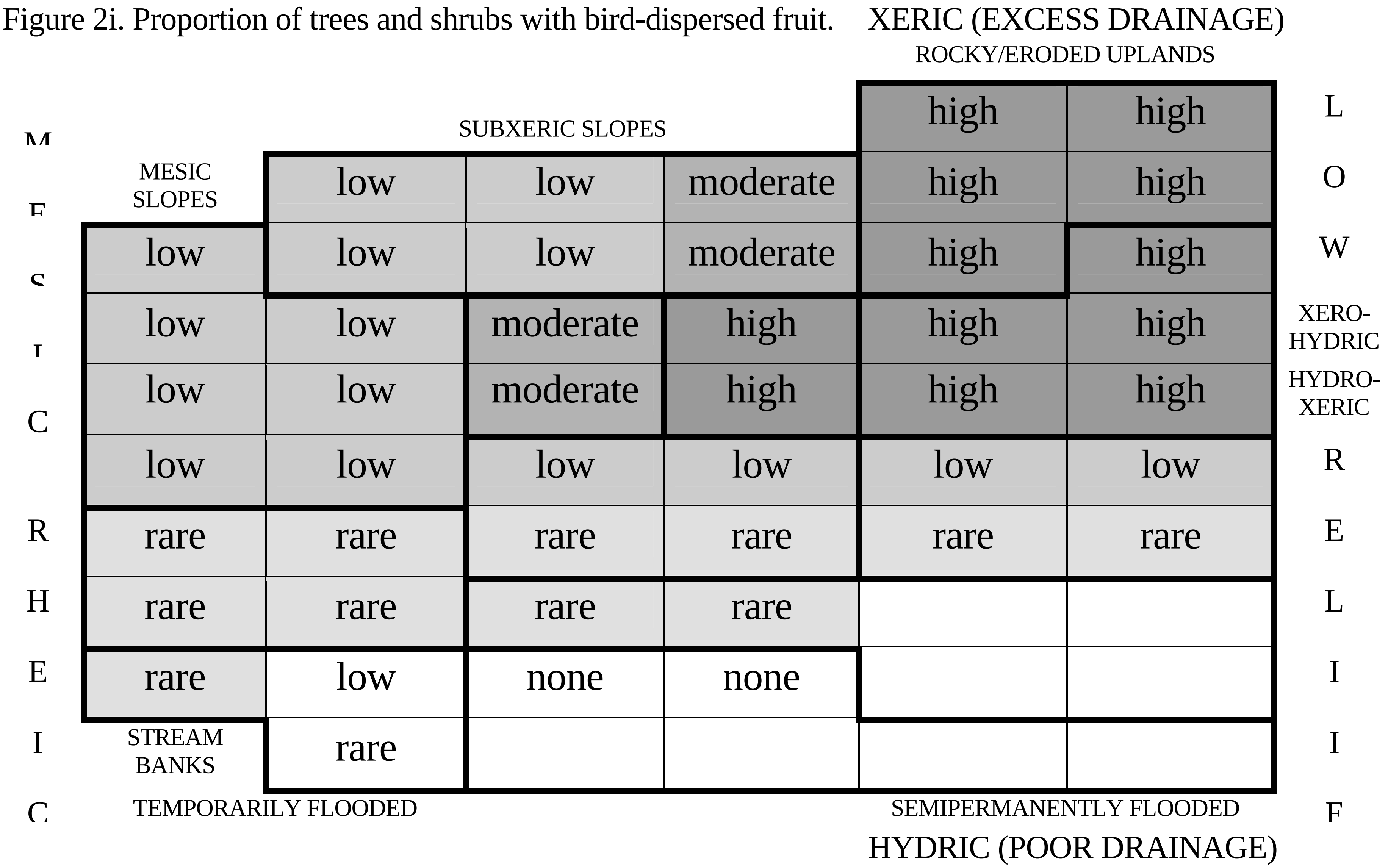
Figure 2h. Proportion of trees and shrubs with thorns or toxins.



				common	common
	moderate	moderate	moderate	common	common
moderate	moderate	moderate	moderate	common	dominant
moderate	moderate	common	common	common	dominant
moderate	moderate	common	common	common	dominant
moderate	moderate	moderate	moderate	moderate	moderate
moderate	moderate	low	low	moderate	moderate
low	low	low	low		
low	low	low	low		
	low				

*
Species with strong thorns or toxins are mostly in Rosaceae, Fabaceae; Fagaceae are generally considered moderate, some though some have high repellance due to tannins.

Figure 2i. Proportion of trees and shrubs with bird-dispersed fruit.



XERIC (EXCESS DRAINAGE)

ROCKY/ERODED UPLANDS

SUBXERIC SLOPES

MESIC SLOPES

				high	high
	low	low	moderate	high	high
low	low	low	moderate	high	high
low	low	moderate	high	high	high
low	low	moderate	high	high	high
low	low	low	low	low	low
rare	rare	rare	rare	rare	rare
rare	rare	rare	rare		
rare	low	none	none		
STREAM BANKS	rare				

TEMPORARILY FLOODED

SEMIPERMANENTLY FLOODED

HYDRIC (POOR DRAINAGE)

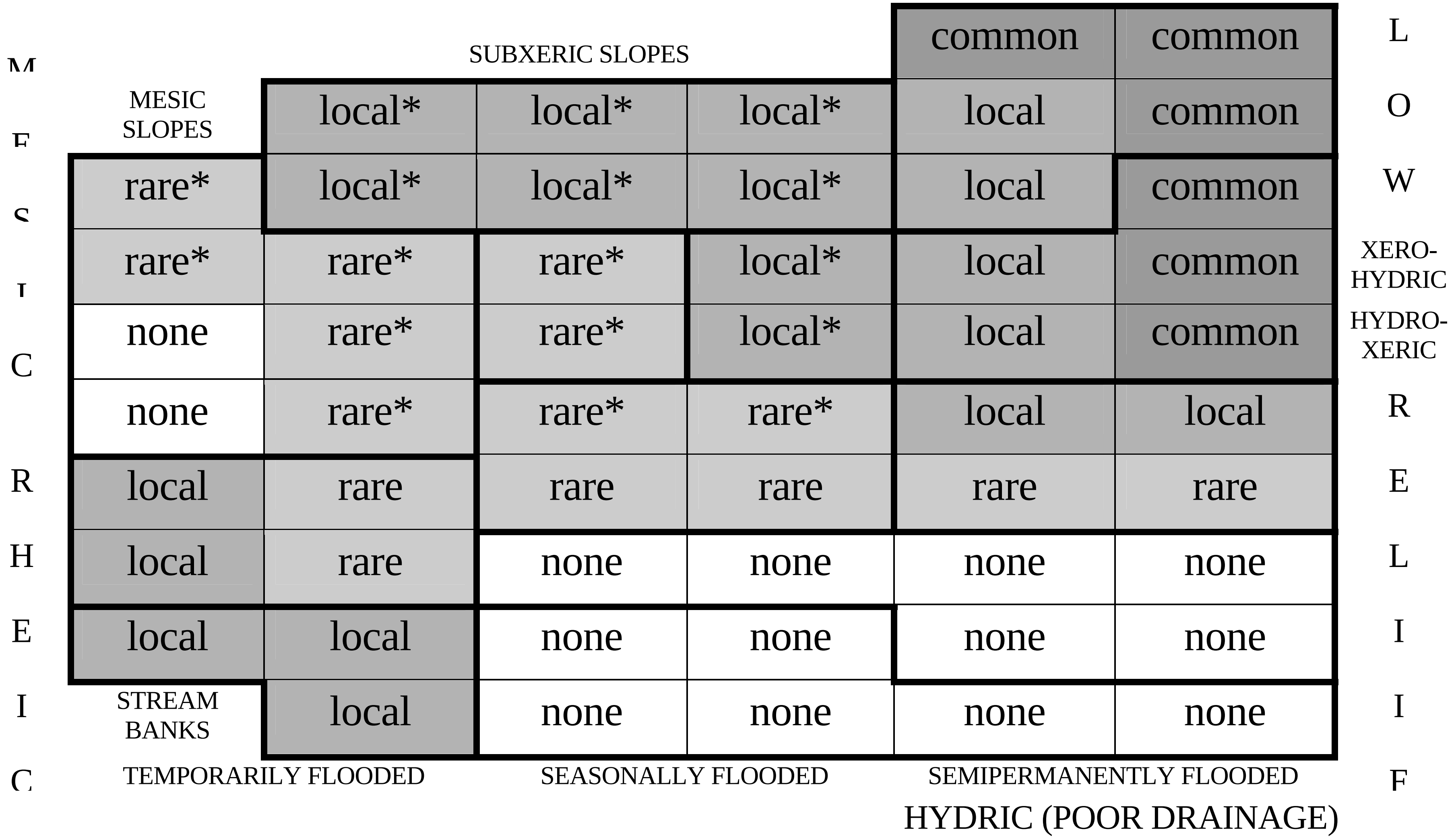
M E S I C R H E I C

L O W XERO-HYDRIC HYDRO-XERIC R E L I E F

*

Species with strong thorns or toxins are mostly in Rosaceae, Fabaceae; Fagaceae are generally considered moderate, some though some have high repellance due to tannins.

Figure 2j. Abundance of native warm-season (C4) graminoids.
In most upland woods the only species are *Muhlenbergia* spp. (*)



XERIC (EXCESS DRAINAGE)
ROCKY/ERODED UPLANDS

SUBXERIC SLOPES

MESIC SLOPES

M
E
S
I
C
R
H
E
I
C

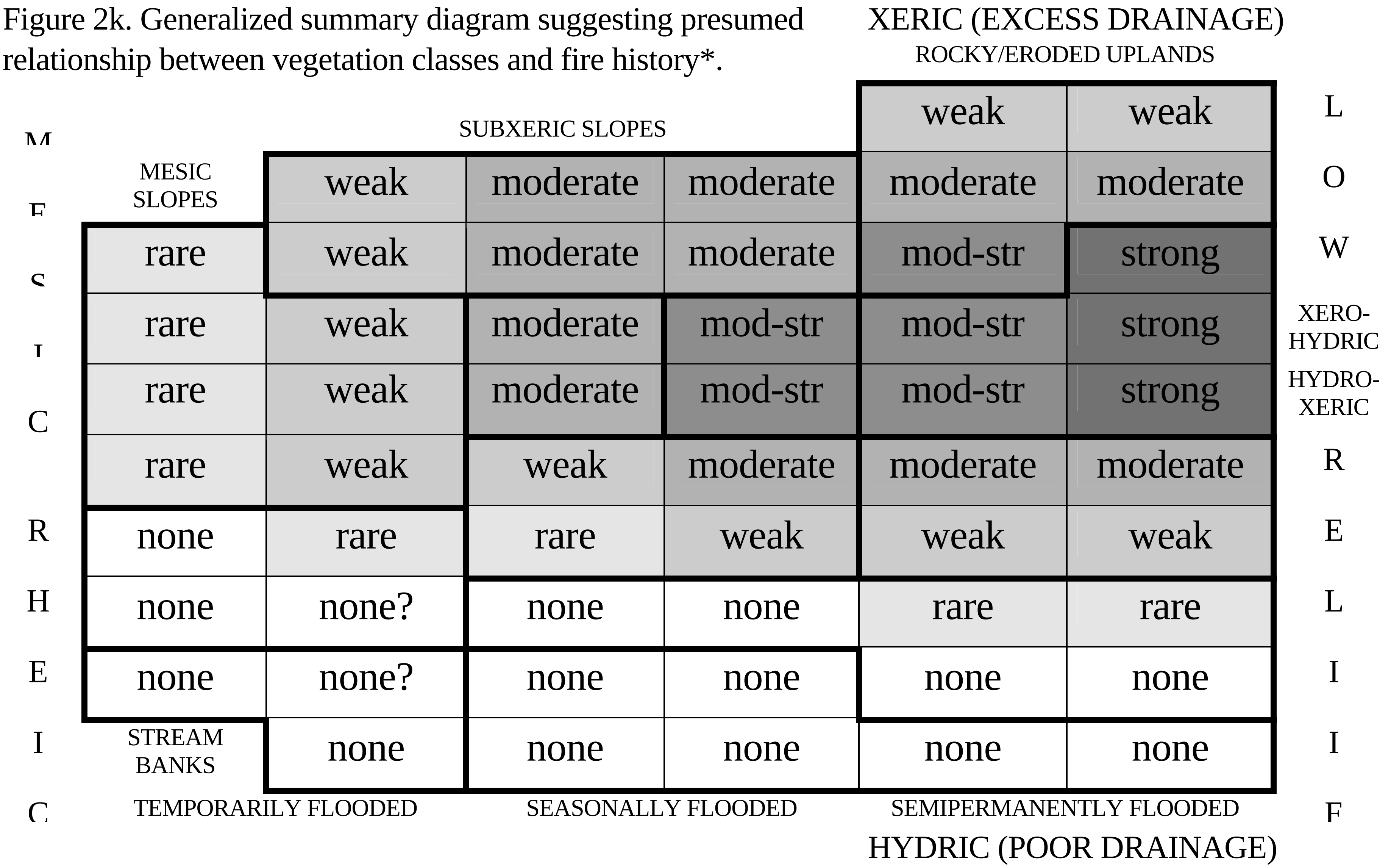
				common	common	L
MESIC SLOPES	local*	local*	local*	local	common	O
rare*	local*	local*	local*	local	common	W
rare*	rare*	rare*	local*	local	common	XERO-HYDRIC
none	rare*	rare*	local*	local	common	HYDRO-XERIC
none	rare*	rare*	rare*	local	local	R
local	rare	rare	rare	rare	rare	E
local	rare	none	none	none	none	L
local	local	none	none	none	none	I
STREAM BANKS	local	none	none	none	none	I

TEMPORARILY FLOODED SEASONALLY FLOODED SEMIPERMANENTLY FLOODED F

HYDRIC (POOR DRAINAGE)

*
Species with densely hairy leaves include walnut, hickories, hackberry, elms, some oaks, hophornbeam, roughleaf dogwood, downy hawthorn, most briars, most plums; species with less dense hairs or variable conditions include basswoods, buckeyes, black maple, white ash, other dogwoods. Other are glabrous or usually so.

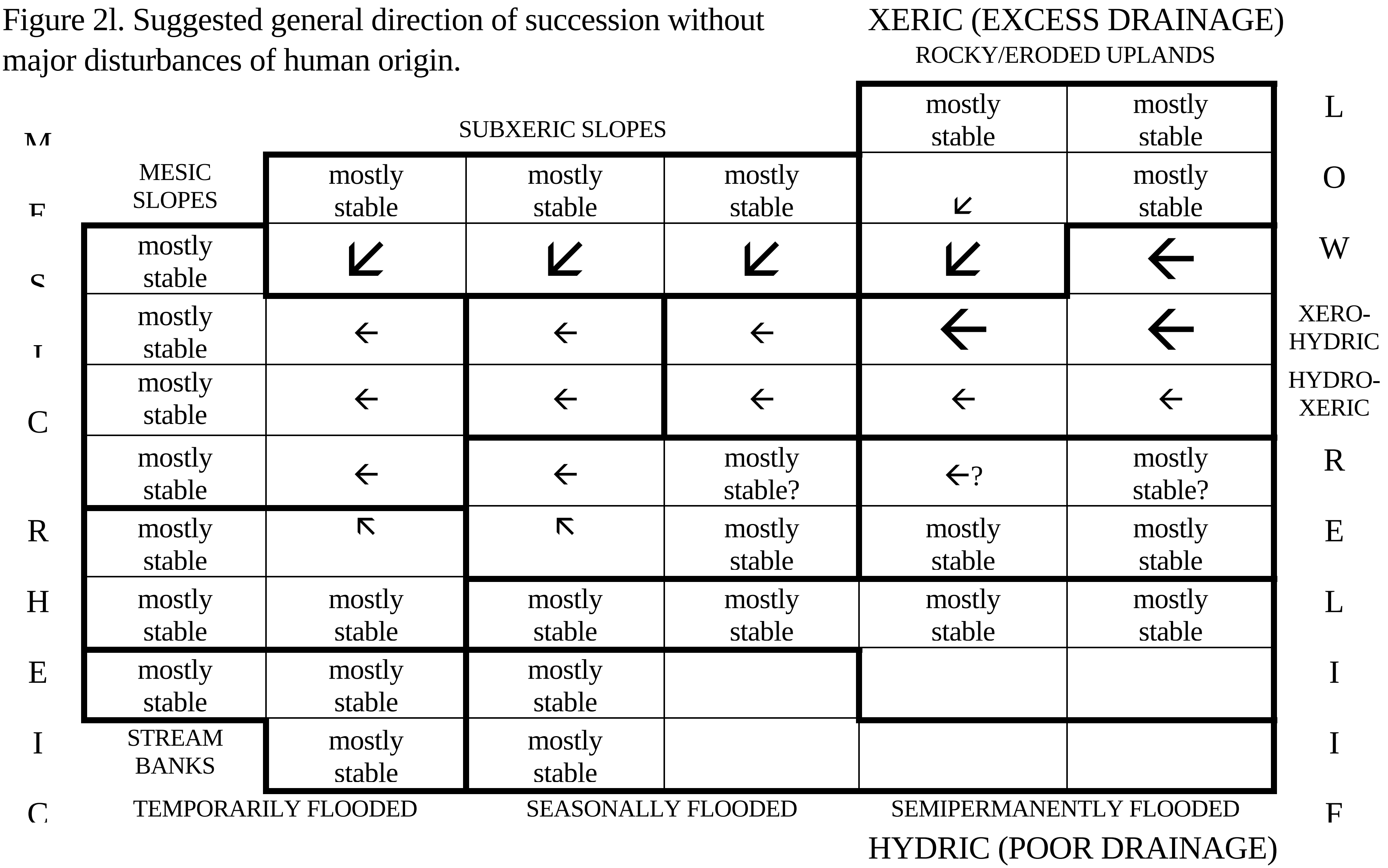
Figure 2k. Generalized summary diagram suggesting presumed relationship between vegetation classes and fire history*.



					weak	weak
MESIC SLOPES	weak	moderate	moderate	moderate	moderate	
rare	weak	moderate	moderate	mod-str	strong	
rare	weak	moderate	mod-str	mod-str	strong	
rare	weak	moderate	mod-str	mod-str	strong	
rare	weak	weak	moderate	moderate	moderate	
none	rare	rare	weak	weak	weak	
none	none?	none	none	rare	rare	
none	none?	none	none	none	none	
STREAM BANKS	none	none	none	none	none	

* Estimated levels of significant effects before settlement: strong = much land burned with effects at ca. 1-5 year intervals; moderate = most land burned with effects at ca.. 5-50 year intervals; weak = most land burned with effects at ca. 50-100+ intervals; rare = most land not influenced by fire; none = no land influenced by fire.

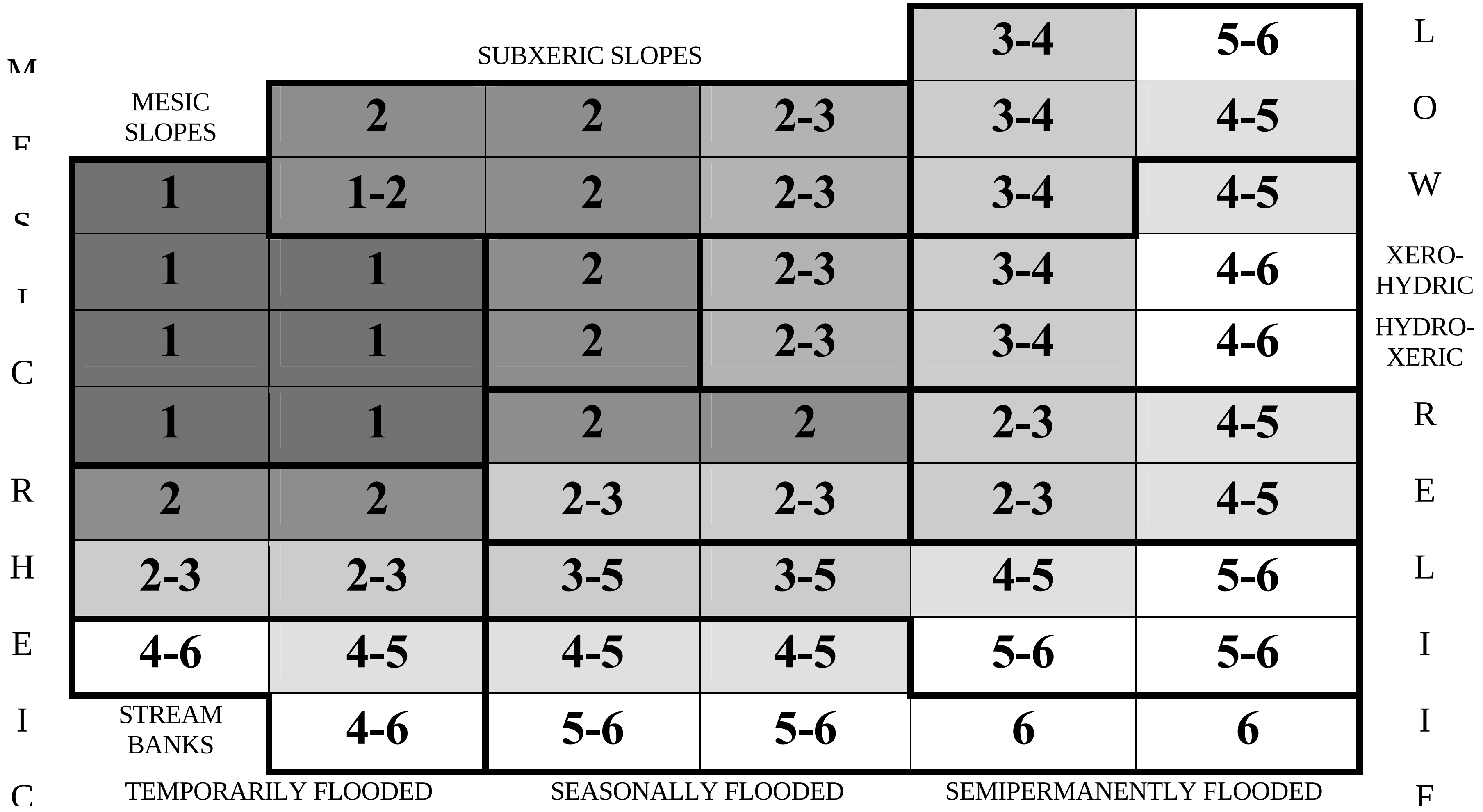
Figure 2l. Suggested general direction of succession without major disturbances of human origin.



				mostly stable	mostly stable
MESIC SLOPES	mostly stable	mostly stable	mostly stable	↙	mostly stable
mostly stable	↙	↙	↙	↙	←
mostly stable	←	←	←	←	←
mostly stable	←	←	←	←	←
mostly stable	←	←	mostly stable?	←?	mostly stable?
mostly stable	↖	↖	mostly stable	mostly stable	mostly stable
mostly stable	mostly stable	mostly stable	mostly stable	mostly stable	mostly stable
mostly stable	mostly stable	mostly stable			
STREAM BANKS	mostly stable	mostly stable			

* Based on general knowledge of vegetation from field work and the literature: see Appendix 3 and Campbell (2001a). Large arrows indicate general directional change for most of the vegetation type (expected within ca. 10-100 years). Small arrows indicate partial, minor or slow changes (expected to take 100+ years for complete transition).

Figure 2m. Generalized division of vegetation into degrees of overall development from bare substrate to deep wooded shade.



				3-4	5-6
MESIC SLOPES	2	2	2-3	3-4	4-5
1	1-2	2	2-3	3-4	4-5
1	1	2	2-3	3-4	4-6
1	1	2	2-3	3-4	4-6
1	1	2	2	2-3	4-5
2	2	2-3	2-3	2-3	4-5
2-3	2-3	3-5	3-5	4-5	5-6
4-6	4-5	4-5	4-5	5-6	5-6
STREAM BANKS	4-6	5-6	5-6	6	6

* Based on general knowledge of vegetation from field work and the literature: see Appendix 3 and Campbell (2001a). Large arrows indicate general directional change for most of the vegetation type (expected within ca. 10-100 years). Small arrows indicate partial, minor or slow changes (expected to take 100+ years for complete transition).

Figure 3. Hypothetical major gradients in composition and eco-morphology within Bluegrass Woodlands before settlement.

These diagrams are designed to allow application of Vera’s (2000) concepts; see text for further explanation. The outline of vegetation types, and the location of each species’ modal position, are first approximations, based on multivariate analysis of modern compositional data within the region, and of eco-morphological characters.

Figure 3a. Overview of structural types and dynamic relationships between them; note that these conceptual types would have intergraded extensively in composition, structure and processes; in reality, there may not have been any special consistency or stability within each of them.

Figure 3b. Typical plants suggested for each structural type; note that most species probably occurred widely in adjacent types. This is only a provisional sketch, to be explored further with ordination methods.

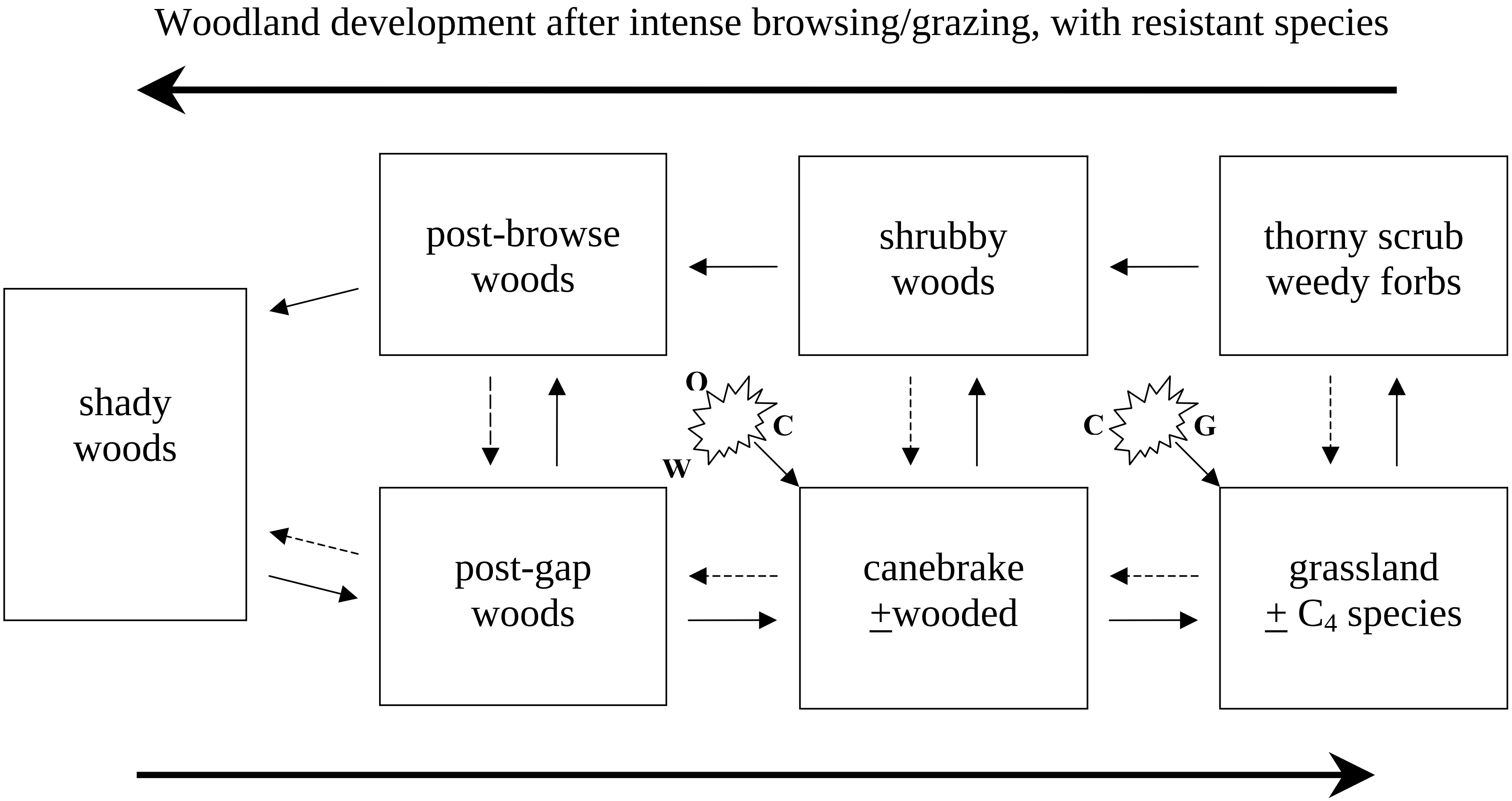
Figure 3c. Primary ecological processes that may have been involved in transitions between types; note that these are largely hypothetical within the context of Bluegrass woodlands, but several are consistent with literature elsewhere. Only the primary suggested directional trends are detailed here; the potential for reversed trends is discussed in the text.

These processes are identified by each transition (A1-3, B1-3, C1-3) and subcategories within each transition (a,b,c,d,e).
Transitions B1, B2 and B3, with no room in the diagram, are detailed here.

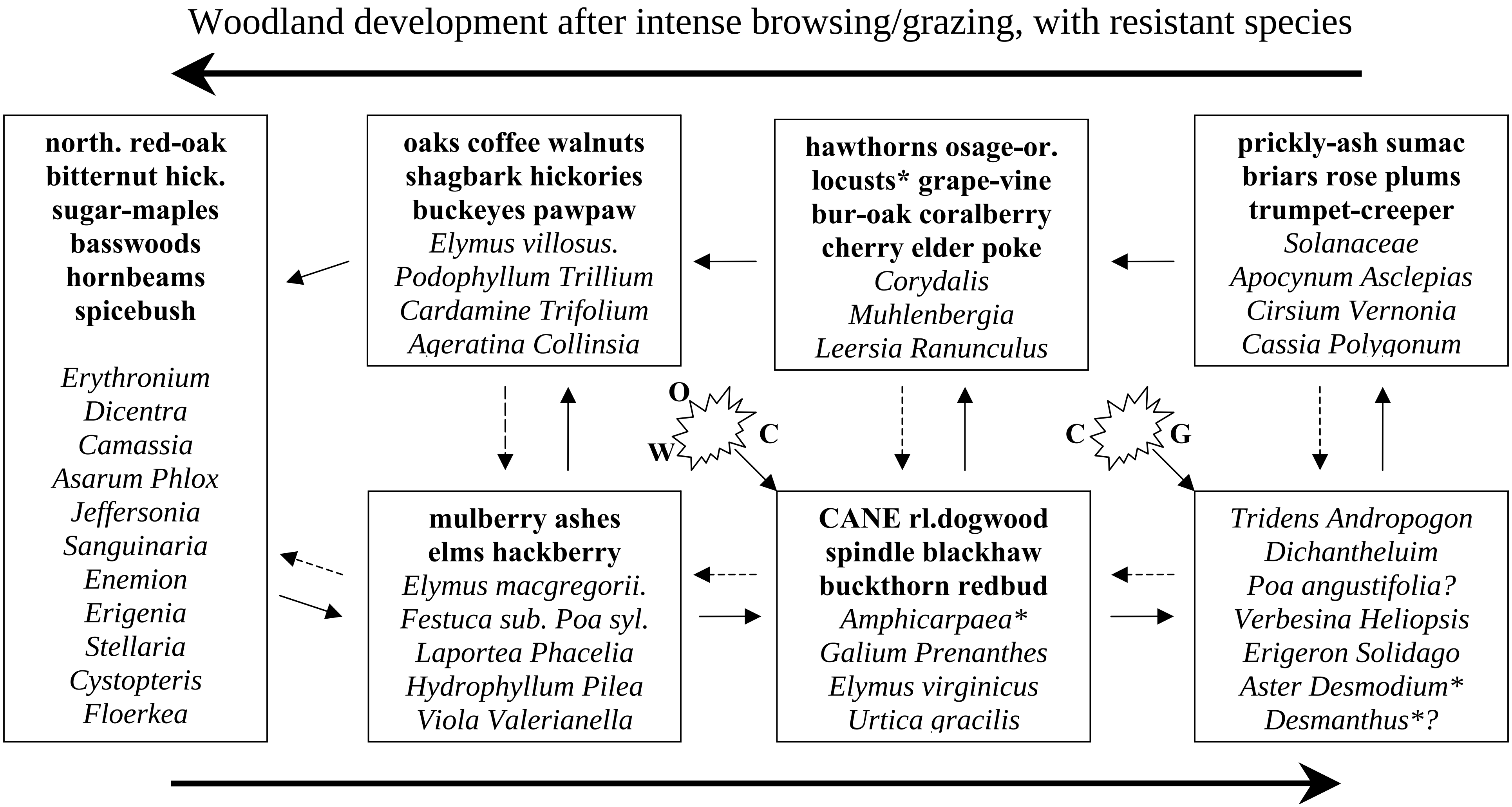
B1a	Decrease in browsing-sensitive plants, especially grasses, elms, ashes.
B1b	Increase in browsing-resistant plants, especially trees with large/nutty seeds.
B1c	Decrease in prolonged winter/spring browsing; continued along trails and for fruit/nuts.

B2a	Decrease in cane, hog-peanut, and other browsed plants.
B2b	Increase in browsing-resistant plants, especially thorny/suckering locusts,weedy/toxic forbs & shrubs.
B2c	Regeneration of more resistant long-lived trees with large seeds.
B2d	Decrease in prolonged browsing; continued along trails, and for fruit/nuts.

B3a	Decrease in grasses and palatable forbs.
B3b	Increase in browsing-resistant plants, especially toxic forbs & thorny scrub.
B3c	Decrease in browsing, except along trails.
B3d	Increase in birds feeding and roosting in scrub; local input of minerals in droppings.



Tree canopy decline due to wind/ice, dry/wet episodes, pests/pathogens, fire, cutting; plus increases in forage for ungulates/other herbivores; formerly elephants/mammoths. Potential fuel types are: W = woody debris; O = oak litter; C = old cane; G = old grass.



Woodland development after intense browsing/grazing, with resistant species

north. red-oak
bitternut hick.
sugar-maples
basswoods
hornbeams
spicebush

Erythronium
Dicentra
Camassia
Asarum Phlox
Jeffersonia
Sanguinaria
Enemion
Erigenia
Stellaria
Cystopteris
Floerkea

oaks coffee walnuts
shagbark hickories
buckeyes pawpaw
Elymus villosus.
Podophyllum Trillium
Cardamine Trifolium
Ageratina Collinsia

hawthorns osage-or.
locusts* grape-vine
bur-oak coralberry
cherry elder poke
Corydalis
Muhlenbergia
Leersia Ranunculus

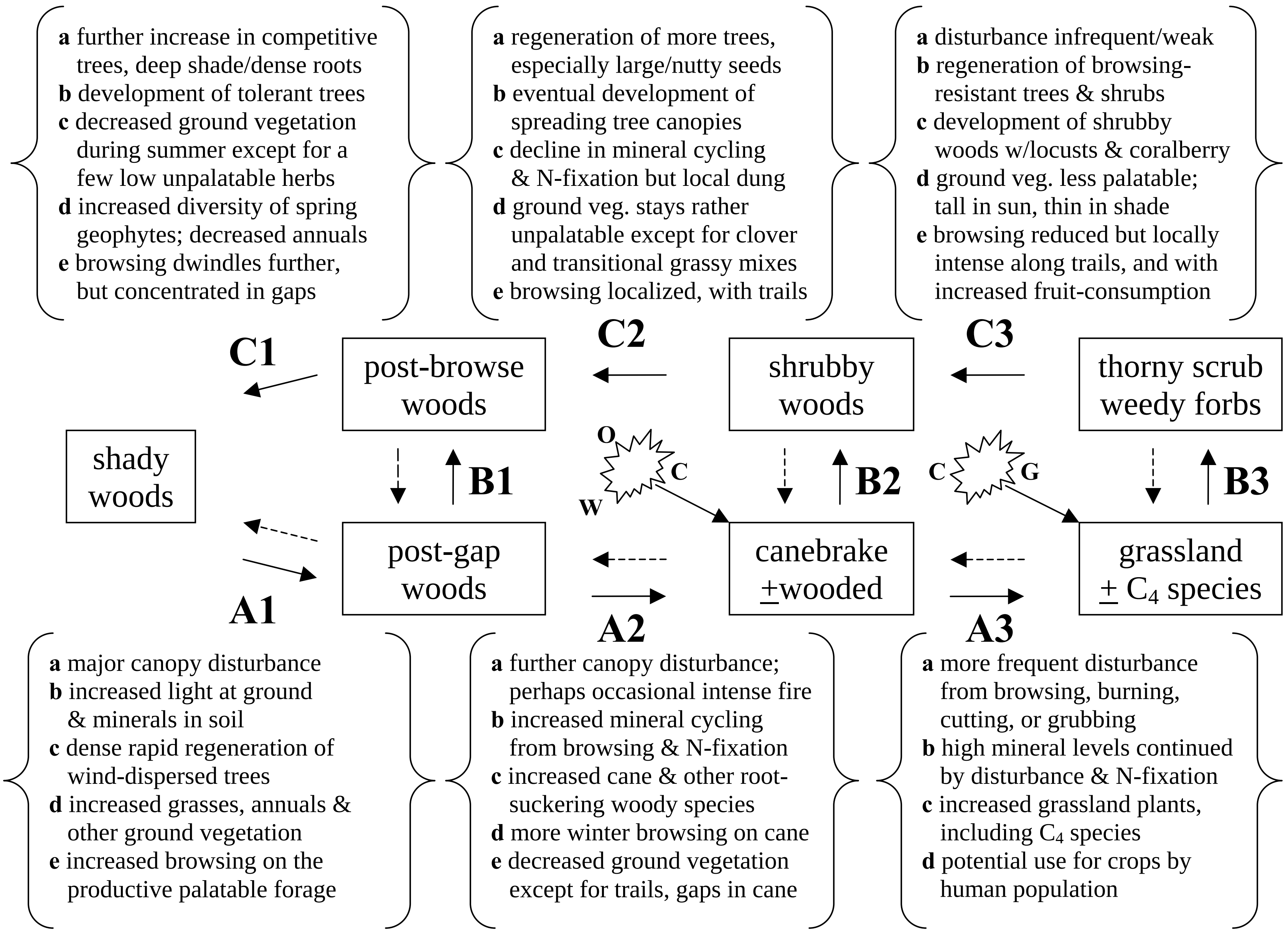
prickly-ash sumac
briars rose plums
trumpet-creeper
Solanaceae
Apocynum Asclepias
Cirsium Vernonia
Cassia Polygonum

mulberry ashes
elms hackberry
Elymus macgregorii.
Festuca sub. Poa syl.
Laportea Phacelia
Hydrophyllum Pilea
Viola Valerianella

CANE rl.dogwood
spindle blackhaw
buckthorn redbud
*Amphicarpaea**
Galium Prenanthes
Elymus virginicus
Urtica gracilis

Tridens Andropogon
Dichantheluim
Poa angustifolia?
Verbesina Heliopsis
Erigeron Solidago
*Aster Desmodium**
Desmanthus?*

Tree canopy decline due to wind/ice, dry/wet episodes, pests/pathogens, fire, cutting; plus increases in forage for ungulates/other herbivores; formerly elephants/mammoths. Potential fuel types are: W = woody debris; O = oak litter; C = old cane; G = old grass. Asterisks indicate nitrogen-fixing legumes.



C1
- **a** further increase in competitive trees, deep shade/dense roots
- **b** development of tolerant trees
- **c** decreased ground vegetation during summer except for a few low unpalatable herbs
- **d** increased diversity of spring geophytes; decreased annuals
- **e** browsing dwindles further, but concentrated in gaps

C2
- **a** regeneration of more trees, especially large/nutty seeds
- **b** eventual development of spreading tree canopies
- **c** decline in mineral cycling & N-fixation but local dung
- **d** ground veg. stays rather unpalatable except for clover and transitional grassy mixes
- **e** browsing localized, with trails

C3
- **a** disturbance infrequent/weak
- **b** regeneration of browsing-resistant trees & shrubs
- **c** development of shrubby woods w/locusts & coralberry
- **d** ground veg. less palatable; tall in sun, thin in shade
- **e** browsing reduced but locally intense along trails, and with increased fruit-consumption

A1
- **a** major canopy disturbance
- **b** increased light at ground & minerals in soil
- **c** dense rapid regeneration of wind-dispersed trees
- **d** increased grasses, annuals & other ground vegetation
- **e** increased browsing on the productive palatable forage

A2
- **a** further canopy disturbance; perhaps occasional intense fire
- **b** increased mineral cycling from browsing & N-fixation
- **c** increased cane & other root-suckering woody species
- **d** more winter browsing on cane
- **e** decreased ground vegetation except for trails, gaps in cane

A3
- **a** more frequent disturbance from browsing, burning, cutting, or grubbing
- **b** high mineral levels continued by disturbance & N-fixation
- **c** increased grassland plants, including C_4 species
- **d** potential use for crops by human population

Table XX. General targets for conservation, initial priorities for action, summaries of progress (see also next page).

Conservation Targets	Goals and Strategies	Research Problems	Priority Projects	Progress Reports
1. Landscape Level: General Goal [priorities with asterisks]	**Restore a parcel of the central Bluegrass towards natural conditions**	**Geographic analysis of soil fertility (esp. P), land use history & hydrology**	**Mapping of natural P levels, Virginian witness-tree data, human uses**	**[To be developed in a subsequent document]**
(a)* Best opportunity for restoration of native woodland on uplands of central Bluegrass	Develop working-group on farm and public support; sustain funding partly with some income from the farm	Explore economic models, business plans, cooperative systems for sustainable management with natives	Focus on how to derive appropriate farm income from native plants, fruits & nuts, wood products, game	?
(b) Part of Lower Licking River watershed program (peripheral)	Integrate watershed and farm planning, demonstration, education & research	Small-scale analysis of farm watersheds in relation to land use effects	Focus on potential demonstration of riparian plantings with cane, etc.	
(c) Potential center for rural greenbelt around southern Harrison Co. (possible)	Explore partnerships with local governments and neighborhoods in area	Conduct regional surveys to gauge support for rural preservation, best land uses	Meet with neighbors and local leaders in community to advance mutual interests	
2. Habitat Level: General Goal [priorities with asterisks]	**Begin to simulate original topographic patterns of habitats & disturbances**	**Analysis of current and historical relationships with disturbance**	**Measure effects of deer & livestock using exclosures, deep shade to full sun**	
(a)* Mesic eutrophic woodland (sugar maples, bitternut hickory, etc.)	Set aside 50-100 acres of woods to make diverse experimental plantings	Analysis of limitations for species of deeper shade; include dispersal patterns	Compare spread of selected species at initial plantings in various levels of shade	
(b)* Submesic eutrophic woodland (walnuts, elms, ashes, buckeyes, oaks, etc.)	Plan most woods (200-400 acres) for experimental plantings and browsings	Develop experimental plans for controlled plots and open-range browsing	Focus on initial small trials with goats & sheep in order to maintain RB-clover	?
(c)* Canebrakes and open eutrophic woodland or thickets (bur oak, locusts)	Plan most fields (200-400 acres) for experimental planting, browsing, burning	Develop experimental plots for comparing planting- and disturbance-effects on veg.	Cane-prairie-fescue comparisons (USDA); also cane clone comparisons	(!)
(d) Riparian corridors, wetter openings and ponds (local)	Set aside small areas (10-20 acres) for potential habitat, initial plantings	Potential small-scale study of hydrological effects on vegetation	Cane plots in gullies to examine local effects on soil water and chemistry	
(e) Droughty openings on rocky, eroded or compacted soils (local)	Set aside small areas (10-20 acres) for potential habitat, initial plantings	Potential small-scale study of drought-stress effects on vegetation	Small trial plantings with drought-resistant natives; check tap-root problems	

Conservation Targets	Goals and Strategies	Research Problems	Priority Projects	Progress Reports
3. Species Level: General Goal [priorities with asterisks]	**Develop site to propagate, demonstrate & conserve local plant material**	**Relationships of typical species to disturbance, dispersal & herbivory**	**Selected plantings to compare ecologies and effects on alien species**	**[To be developed in a subsequent document]**
(a)* Small trees & large shrubs in general	Potting nursery; larger plots for seed, divisions & demos	Comparative ecology as applied to restoration	RL-dogwood replacement trials for bush-honeysuckle	((!))
(b)** Early/small woodland perennials; esp. RB-clover	Ditto; include controlled environments for RBC	Ditto; find optimal conditions for RC-clover	Experiments with RB-clover in nursery & woods	((!))
(c)** Larger woodland perennials (flw. May-June)	Ditto; include plots in woods to suppress aliens	Ditto; find best natives to compete with aliens	Experiments with wood-nettle, white-snake-root	
(d)** Biennials & winter-annuals of woods, edges	Ditto; include Miami mist etc. for initial "clean-slates"	Ditto; find best ways to produce seed & establish	Measurements of rates of spread into young woods	((!))
(e)** Hog-peanut; some other summer annuals	Ditto; include trials with hog-peanut in cane, etc.	Ditto; find best ways to propagate this unusual sp.	Plantings with cane; study growth, N-fixation	
(f)** Cane; some other small shrubby species	Ditto; improve divisions in plots using amended soil	Ditto; find best ways to propagate & best habitats	Experiment with USDA plantings, clone-collection	((!))
(g)* Tall late summer-fall perennials of fields, edges	Ditto; develop plots for efficient seed collection	Ditto; link plantings to disturbance experiments	Test plantings in USDA plots, other cane, etc.	((!))
(h) Selected summer-fall grassland perennials	Ditto; develop plots for efficient seed collection	Ditto; link plantings to disturbance experiments	Test plantings in USDA plots, other cane, etc.	
(i) Selected woodland grasses & sedges	Ditto; develop plots for efficient seed collection	Ditto; find best ways to produce seed & establish	Measurements of rates of spread into young woods	
4. Worst Alien Species: General Goal [priorities with asterisks]	**Cost-effective alien reduction, native refuges; integrate farm economy**	**Explore & apply ecological controls of aliens versus natives**	**Integrate alien-native analysis into experiments with browsing & burning**	
(a)*** Emerald ash-borer; other tree pests, pathogens	Integrate farm plans with state & regional strategies	Find best ways to secure refuges, seed, nursery, etc.	Determine if resistance exists in populations	
(b)** Garlic-mustard; other woodland biennials/annuals	Native plantings, seasonal browsings, herbicidings (?)	Study competition from planted natives (see above)	Determine if fall-winter browsing can reduce	
(c)** Purple winter-creeper (and other evergreen vines)	Native plantings, seasonal browsings, herbicidings (?)	Assess potential reduction by controlled livestock	Determine if fall-winter browsing can reduce	
(d)** Bush-honeysuckle and some other shrubs	Cutting, use of wood/chip, browsing, native plantings	Ergonomics, economics & applications of methods	Conduct trials with uses of material for goats, chip...	((!))
(e)* Tree-of-heaven, white mulberry and other trees	Compare herbiciding with long-term shading, etc.	Review problems across region and costs/benefits	Measure rates of decline in the TOH patch	((!))
(f)* Tillering-grasses and other grassland runners	Compare herbiciding with long-term succession, etc.	Review problems across region and costs/benefits	Use USDA plantings, etc., to assess costs/benefits	((!))