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VALLEY BOTTOM CLASSIFICATION
UPPER KLAMATH BASIN IFIM STUDIES

Draft

Prepared for

Bureau of Indian Affairs
Portland, Oregon

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VALLEY BOTTOM CLASSIFICATION

Classification of the valley segments corresponding to IFIM sites was done using a modification of the scheme of Cupp (1989). Classification facilitates the recognition of valley segments that have common characteristics and can therefore be expected to behave in similar manners. This is true for the relative importance of various geomorphic and hydrologic processes and also in the response to natural or human-induced change. The Cupp scheme was designed for land use managers in the State of Washington and is based on easily measured geomorphic characteristics: valley bottom slope, valley bottom width, sideslope gradient, channel pattern, nature and pattern of stream corridor features, and the position of the segment in the drainage network.

In many respects the Cupp scheme satisfactorily discriminates valley bottom types, but several persistent characteristics are not resolved by this classification. Cupp's scheme persistently has valley slopes that are too high to discriminate between valley segments, and the scheme fails to delineate incised channels on an otherwise broad surface. The scheme used, as modified, is presented in Table 1. Figures 1 through 3 present in a graphical format the fields represented by the most relevant valley bottom types.

The valley segments were classified through a combination of site reconnaissance and inspection of ground photos, aerial photos, maps. The physical properties were measured from 7.5-minute U.S. Geological Survey topographic maps (scale 1:24,000). Black and white aerial photos at a scale of 1:33,330 were used to characterize the morphology of the valley and channel.

Valley bottom gradient was determined from the distance between map elevation contours, following the valley axis and not the channel trace. In large mainstem channels, the distance between adjacent contours can be miles. In these cases, the elevation drop over the distance between adjacent contours gave representative slope values. In smaller streams, valley segments tend to be shorter and slopes steeper; these valley segments, the slope over five contour intervals was used to give representative values.

Valley bottom width was also determined from maps. The criterion for setting valley margins was the break in slope between the adjacent hill slopes and a flatter bottom. Channels slightly incised into their own alluvium complicate such a clear delineation, because this strict interpretation would preclude the recognition of the nature of the basin. For the important processes affecting valley form, it is relevant whether 30-degree slopes lining the channel extend up only 10 feet to meet a broad plain or whether they extend up 1,000 feet to a ridge crest. Debris flows are likely to be an important process in the second case but not the first. To avoid this problem, the new category "entrenched channels" was introduced.

Sideslope gradient was also taken from the maps; it was measured in areas beyond the defined valley bottom margins.

Channel pattern was determined from maps, both aerial and ground level photos, and reconnaissance. The degree of confinement provided by the valley walls, the sinuosity of the channel, and whether the channel was braided or meandering are described, along with the longitudinal profile.

Landforms and geomorphic features were interpreted from site reconnaissance and from inspection of maps and photos. The description includes recognition of cutoff bends and sloughs on the floodplain, terraces above the channel, alluvial fans, bedrock outcrops, glaciation, the nature of soils and underlying material, valley aspect, and other clues as to the geomorphic history, important processes, and organization of the channel network.

Finally, the position of the valley segment in the context of the stream network is noted, following the methodology suggested by Strahler (1984). The smallest streams, which have no tributaries, are called first-order streams. Two first-order streams coalesce to form a second-order stream. Two second-order streams coalesce to form a third-order stream. The confluence of a lower order stream with a higher order stream does not change the order of the higher order stream. While the categorization in and of itself is not physically based, it usually coincides with progressively larger channels, smaller slopes, more gradual hydrographs, and less non-alluvial processes as one moves downstream.

The general scheme includes an alphanumeric code:

F valley segments that have nearly flat cross-sectional profiles and gentle sideslope relief. These are typically found in lowland plains and in mainstem valleys.

M valley segments that have slightly steeper gradients and steeper side slopes, but are still moderate. They are found in lowland plains and more upland settings.

V valley segments have narrow, V-shaped aspects and are typically found in more upland areas or in deeply unused regions.

U valley segments have U-shaped aspects and are usually found in upland areas, especially where glaciation has occurred.

H valley segments are steep and narrow drainageways in upland reaches or tributaries to incised mainstream channels.

The number following the letter refers in some sense to the subclass within the general category.

In addition, a number of channels were found to be incised slightly into the valley. This entrenchment alters the frequency of overbank flooding and in many cases indicates that the channel is undergoing some adjustment to discharge or sediment supply. To indicate this state of entrenchment, a prefix "e" was added to the classification.

The valley bottom type corresponding to each studied site and the pertinent information used to make this assignment are listed in Table 2. The plotting position of each site is shown in Figures 4-6. Table 3 lists by valley type the segments studied in this analysis.

REFERENCES

Cupp, C.E. 1989. Valley segment type classification for forested lands of Washington, report prepared for Washington Forest Protection Association, 19 pp + appendix.

Strahler, A. N. 1964. Quantitative geomorphology of drainage basins and channel networks: Section 4-2 in Handbook of Applied Hydrology, ed. Ven te Chow, McGraw-Hill, New York.

TABLE 1 VALLEY BOTTOM AND SLIDESLOPE GEOMORPHIC CHARACTERISTICS USED TO IDENTIFY VALLEY SEGMENT TYPES IN OREGON BASED UPON MODIFICATION OF CLASSIFICATION SCHEME OF CUPP (1989. CHANNEL WIDTH IS INDICATED BY X. STREAM ORDER IS DEFINED BY METHOD OF STRAHLER (1984)

Valley Segment Type	Valley Bottom Gradient	Sideslope Gradient	Valley Bottom Width	Channel Pattern	Stream Order	Landform and Geomorphic Features
F1 Tide-affected data	<0.001%	<1%	>20x	Unconstrained highly sinuous	Any	Occurs at mouths of rivers where tides effect flow.
F2 Alluviated lowlands	<0.5%	<1%	>20x	Unconstrained sinuous	Any	Wide floodplains in large valley with gently rolling slopes; oxbows, meanders, sloughs.
F3 Wide valleys	<0.5%	1-5%	>10x	Unconstrained moderately sinuous	Any	Fairly wide but steeping sideslopes; typical of well dissected landscape; oxbows, sloughs, meanders.
F4 Alluvial drainageways	<0.5%	5-10%	>10x	Unconfined meandering to straight	Any	Fairly wide floodplain in valley well incised into surrounding highlands.
F5 Alluvial/colluvial fans	>0.5%	1-10%	>10x	Unconfined straight to slightly sinuous	1-3	Steeper, typically smaller channels flowing over fans; commonly the channel is slightly entrenched.
M1 Moderately slope bound	<0.5%	5-20%	2-5x	Moderately confined some sinuosity	1-4	Moderately constrained valley with relatively steep sideslopes close to the channel; narrow but active floodplain.
M2 Moderately slope bound	>0.5%	5-20%	2-5x	Moderately confined	1-4	Moderately constrained valley with relatively steep sideslopes close to the channel; narrow but active floodplain.

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Valley Segment Type	Valley Bottom Gradient	Sideslope Gradient	Valley Bottom Width	Channel Pattern	Stream Order	Landform and Geomorphic Features
V0 Canyons/water gaps	<0.5%	>10%	<2x	Confined	3-5	Gently sloped channels deeply incised into adjacent highlands; in many cases these are called "gaps" between sequential valley flats.
V1 V-shaped canyon	.5-2%	>10%	<2x	Confined	Any	Narrow valley bottoms at the base of steep slopes shedding debris flows. Channel slope is insufficient to transport debris flows.
V2 V-shaped moderately sloped	>2%	10-20%	<2x	Confined	Any	Narrow valley bottom at the base of steep slopes shedding debris flows. The channel slope is capable of transporting debris flows.
V3 V-shaped mountain cascade	>2.0%	>20%	<2x	Confined	1-3	Steep boulder of channel in a narrow V-shaped drainage whose sideslopes shed frequent debris flows.

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Valley Segment Type	Valley Bottom Gradient	Sideslope Gradient	Valley Bottom Width	Channel Pattern	Stream Order	Landform and Geomorphic Features
H1 Moderate-gradient valley wall/headwater	3%-6%	>30%	<2x	Constrained	1-2	Small drainage ways with channels slightly to moderately entrenched into mountain toeslopes or headwater basins
H2 High-gradient valley wall/headwater	6%-11%	>30%	<2x	Constrained; stairstepped	1-2	Small drainageways with channels moderately entrenched into high gradient mountain slopes or headwater basins; bedrock exposures and outcrops common; localized alluvial/colluvial terrace deposition
H3 Very-high-gradient valley wall/headwater	11% +	>60%	<2x	Constrained; stairstepped	1-2	Small drainageways with channels moderately entrenched into very steep mountainslopes or headwater basins; bedrock exposures and outcrops frequent
U1 U-shaped trough	<3%	<5%; gradually increases to 30% +	>4x	Unconstrained; moderate to high sinuousity; side channels and braids common	1-4	Drainageways in mid to upper watersheds with history of glaciation, resulting in U-shaped profile; valley bottom of glacial drift overlain with alluvial material adjacent to channel

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Valley Segment Type	Valley Bottom Gradient	Sideslope Gradient	Valley Bottom Width	Channel Pattern	Stream Order	Landform and Geomorphic Features
H1 Moderate-gradient valley wall/headwater	3%-6%	>30%	<2x	Constrained	1-2	Small drainage ways with channels slightly to moderately entrenched into mountain toeslopes or headwater basins
U2 Incised colluvium/till, moderate-gradient bottom	2%-5%	steep channel adjacent slopes, decreases to <30%, then increases to >30%	<2x	Moderately constrained by unconsolidated material; infrequent short flats with braids and meanders	2-5	Channel downcuts through valley bottom glacial till, colluvium or glacio fluvial deposits; cross sectional profile weakly U-shaped with active channel incised into valley fill deposits; sideslopes composed of unconsolidated deposits
U3 incised colluvium/till, high-gradient bottom	6%-11%	steep channel adjacent slopes, descrease to <30%, then increases to >30%	<2x	Moderately constrained by unconsolidated material; infrequent short flats with braids and meanders	2-5	Channel downcut through valley bottom glacial till, colluvium or glaciofluvial deposits; cross sectional profile generally weakly U-shaped with active channel incised into valley fill sideslopes composed of unconsolidated coarse grained deposits
U4 active glacial outwash valley	1%-7%	initially <5%, increasing to >60%	<4x	Unconstrained; highly sinuous and braided	1-3	Stream corridors directly below active alpine glaciers; channel braiding and shifting common; active channel nearly as wide as valley bottom

TABLE 2 INFORMATION FORMING THE BASIS OF VALLEY BOTTOM CLASSIFICATION

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SITE #	LOCATION	MAP	AIR PHOTO	VALLEY SLOPE	SIDE SLOPES	DEGREE OF CONFINEMENT	CHANNEL PATTERN	OTHER INFORMATION	VBT
WM-1	Williamson • Highway 97 to Lake	Agency Lake	18-23	<0.03%	<1%	unconfined	wandering	willow on bank gravel in bank	F2
WM-2	• Sprague to Hwy 97	Chiloquin Agency Lake	18-67	0.06%	5-15%	mod 2-4W	slightly sinuous	sage on valley flat	M1
WM-3	• Sprague to Spring Cr.	Soloman Butte Ft. Klamath	18-69	0.05%	5-15%	2-4W moderately confined	straight		M1
WM-4	• Lower end Kirk Canyon to Spring Cr.	Soloman Butte	18-69,71	<0.06%	steep banks otherwise 2-15%	Little - slightly incised	mod sinuous meandering	coarse bed; boulders up to 1 m slightly incised into an old delta, lake platform?	eF4
WM-5	• Kirk to lower end Kirk Canyon	Soloman Butte	18-75	4.0%	10-25%	confined	straight	coarse bed, retreating knickpant incised bedrock.	V2
WM-6	• Klamath Marsh to Kirk	Fuego	2-98,100	<0.05%	1-5%	unconfined	locally sinuous	channel flows through marshy alluviated valley	F3
WM-7	• Deep Creek to Marsh	The Bull Pasture Gordon Lake	7-32	0.04%	1-5%	unconfined	sinuous meandering	channel flows through broad meadow, locally marshy; old cutoffs	F3
WM-8	• Wickiup Spring to Deep Creek	The Bull Pasture	7-28	<0.05%	5-10%	unconfined	sinuous meandering	channel flows through marshy valley	F4
WM-9	• Campground Springs to Wickiup	The Bull Pasture Fuego Mtn	7-26	<0.1%	5-10%	unconfined	sinuous meandering	channel flows through marshy valley	F4
WM-10	Larkin Creek	Soloman Butte	18-69,71	0.4%	5%	mod. confined incised meanders	slightly sinuous	tributary incised into alluvium	eF3
WM-11	Sand Creek	Sun Pass	don't have 18-40,42	1.0%	<5%	confined - incised into alluvial fan?	straight	incised into alluvial fan?	eF5
WM-12	Scott Creek	Pothole Butte	don't have 18-38	0.7%	<3%	<3W confined - incised into aluvian fan	straight	narrow shallow channel	eF5
WM-13	Cottonwood Creek	Welsh Butte don't have	don't have 15-100	2.1%	<5%	incised channel	straight	narrow brushy valley incised large logjams	eF5

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WM-14	Jackson Creek	Gordon Lake		3.0%	5-20%	confined	straight	boulder bottom, forested banks LOD important	V2
WM-15	Irving Creek	Gordon Lake	7-34	4.6%	10-20%	confined	wandering	small narrow channel, dry; gully organic debris formative elements	V2
WM-16	Deep Creek	The Bull Pasture	7-30?	5.3%	5-20%	confined	straight?	small narrow channel organic detritus important	V2
WD-1	Wood River • Fort Creek to Agency Lake	Fort Klamath	don't have	0.1%	<1%	unconfined	sinuous meandering	leveed, channel in structural valley	F2
WD-2	• Annie Creek to Fort Creek	Fort Klamath	don't have 11-112	0.2%	<1%	unconfined	sinuous meandering	well defined bankfull channel in large structural valley	F2
WD-3	Crooked Creek	Fort Klamath	18-27	0.1%	<1%	unconfined	sinuous meandering		F2
SP-1	Sprague River • Chiloquin Dam to Williamson	Chiloquin	18-67	0.5%	5-20%	mod 2-3W	straight-slightly sinuous	large boulders on bed entrenched into alluvium	M1
SP-2	• Braymill to Chiloquin Dam	Chiloquin	18-67	0.3%	10-25%	mod 2-3W	wandering/ straight	near gage emerging from canyon	M1
SP-3	• upper S'Ocholis Canyon to Braymill	S'Ocholis Canyon	8-126	0.05%	40-60%	confined <2W	wandering	looks like a flooded valley	V0
SP-4	• Trout Creek to S'Ocholis Canyon	Buttes of the Gods	16-33	0.05%	5-15%	mod confined	meandering	old mender scars bed is fine	M1
SP-5	• Sycan to Trout Creek	Sprague River West	17-26	<0.03%	1-5%	unconfined >10W	meandering sinuous	bed <1mm locally at valley wall	F3
SP-6	• Kirk Spring to Sycan River	Beatty	8-23	0.06%	1-5%	unconfined	sinuous meanders	general valley properties many meander scars near Beatty Gap gage	F3
SP-7	• NF/SF Sprague to Kirk Spring	Ferguson Mountain	8-158	<0.04%	<1% increasing to 5-19	unconfined	sinuous meandering		F2

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SP-8	Trout Creek	Sprague River West	don't have 16-30	1.7%	20-50%	2-4W confined	straight	in canyon boulders in 7' channel	V1
SP-9	Whisky Creek	Beatty	7-209	0.2%	1-5%	unconfined	highly sinuous		F3
SP-10	NF Sprague • Balley Flats to NF/SF	Bly	19-172,174	0.08%	2-10%	entrenched in alluvium	mod. sinuous	Also Called NF Sprague @ AC livestock degradation slightly entrenched or downsized meandering channel?	eF4
SP-11	Boulder Creek to Balley Flats	Sandhill Crossing	37-95	3.7%	60-70%	confined <2W	straight	canyon Also Called NFS @ FSB cobble bed a floodplain bench with veg. and fines	V3
SP-12	Fivemile Creek • Mouth to USFS boundary	Bly	19,172,174	0.5%	5-15%	entrenched by 1'? >10W	sinuous meandering	Also called: 5 mile at AC Ranch	F5
SP-13	• Headwaters to USFS boundary	Rodeo Butte	19-244	0.7%	5-15%	unconfined >20W	sinuous meandering	Also Called: upper 5 mile Creek very low banks; in grassy meadow	F5
SP-14	SF Sprague River • Fishhole Creek to NF/SF	Bly	19-240	0.09%	<1.0	unconfined	straight	leveed, straightened	F2
SP-15	• Ish Tish to Fishhole Creek	Campbell Reservoir	37-89	02%	<5%	valley unconfined channel entrenched	slightly incised	Also Called = SF Sprague below canyon	eF3
SP-16	• Brownsworth Creek to Ish Tish Creek	Campbell Reservoir	37-23	1.0%	50%	confined <3W	straight	bouldery bed	V1
SP-17	Deming Creek	Campbell Reservoir	37-27	6.7%	>30%	confined	straight cascade	small cobble channel, extensive aldus	V3
SY-1	Sycan River • Blue Creek to Snake Creek	Spodue Mtn	7-215	<0.1%	5-10%	entrenched in alluvium unconfined	slightly sinuous	sand bed inset into valley flat debouches from canyon	F4
SY-2	• Teddy Powers Meadow to Blue Creek	Spodue Mtn	7-217	0.7%	10-25%	confined 2-3W	straight	in canyon	V1
SY-3	• Torrent Springs to Teddy Power M.	Silver Dollar Flat	8-33	0.2%	5-25%	mod confined 2-4W	slightly sinuous	Also Called: Sycan near Teddy Powers Meadow cobble channel bed	M1

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SITE #	LOCATION	MAP	AIR PHOTO	VALLEY SLOPE	SIDE SLOPES	DEGREE OF CONFINEMENT	CHANNEL PATTERN	OTHER INFORMATION	VBT
SY-4	• Merritt Creek to Torrent Springs	Riverbed Butte Spring	8-169	0.2%	5-25%	confined 1-2W	straight	boulders - dry during visit	V0
SY-5	• Guard Station to Merritt Creek	Riverbed Butte Spring	8-171	0.2%	15-25%	confined 2-3W	straight to wandering	Also Called: Sycan below Marsh overflow from marsh no flowing water during visit	V0
SY-6	• Long Creek to Guard Station	Sycan Marsh East	20-233	0.5%	15-30%	confined 2-3	straight to meandering	Also Called: Sycan @ 2X cobble channel bed	V0
SY-7	• Paradise Creek to Long Creek	Shake Butte	don't have 37-35	0.8%	15-40%	confined 2-3W	straight	cobbie bed channel in well defined banks	V1
SY-8	Long Creek	Sycan Marsh West	19-190	0.5%	1-10%	unconfined	sinuous meandering	fine channel bed grassy valley floor	F5
SY-9	Calahan Creek	Hamelton Butte	8-40	2.0%	5-15%	rel. unconfined <10W	sinuous	LOD across channel forested valley bottom	F5
SY-10	Coyote Creek	Sycan Marsh West	19-192	0.7%	<1% rising to 5-15%	unconfined >20W	sinuous meandering	finebed near culvert grassy valley	F5

TABLE 3 VALLEY BOTTOM CLASSIFICATION OF SITES

V Valleys

V0
SY-4
SY-5
SY-6
SP-3

V1
SY-2
SY-7
SP-8
SP-16

V2
WM-5
WM-14
WM-15
WM-16

V3
SP-11
SP-17

M Valleys

M1
SY-3
WM-2
WM-3
SP-1
SP-2
SP-4

F Valleys

F2
WD-1
WD-2
WD-3
SP-7
SP-14
WM-1

F3
WM-6
WM-7
SP-5
SP-6
SP-9

F4
WM-8
WM-9
SY-1

F5
SY-8
SY-9
SY-10
SP-12
SP-13

e
eF4=WM-4
eF3=W-10
eF5=WM-11,12,13
eF4=SP-10
eF3=SP-15

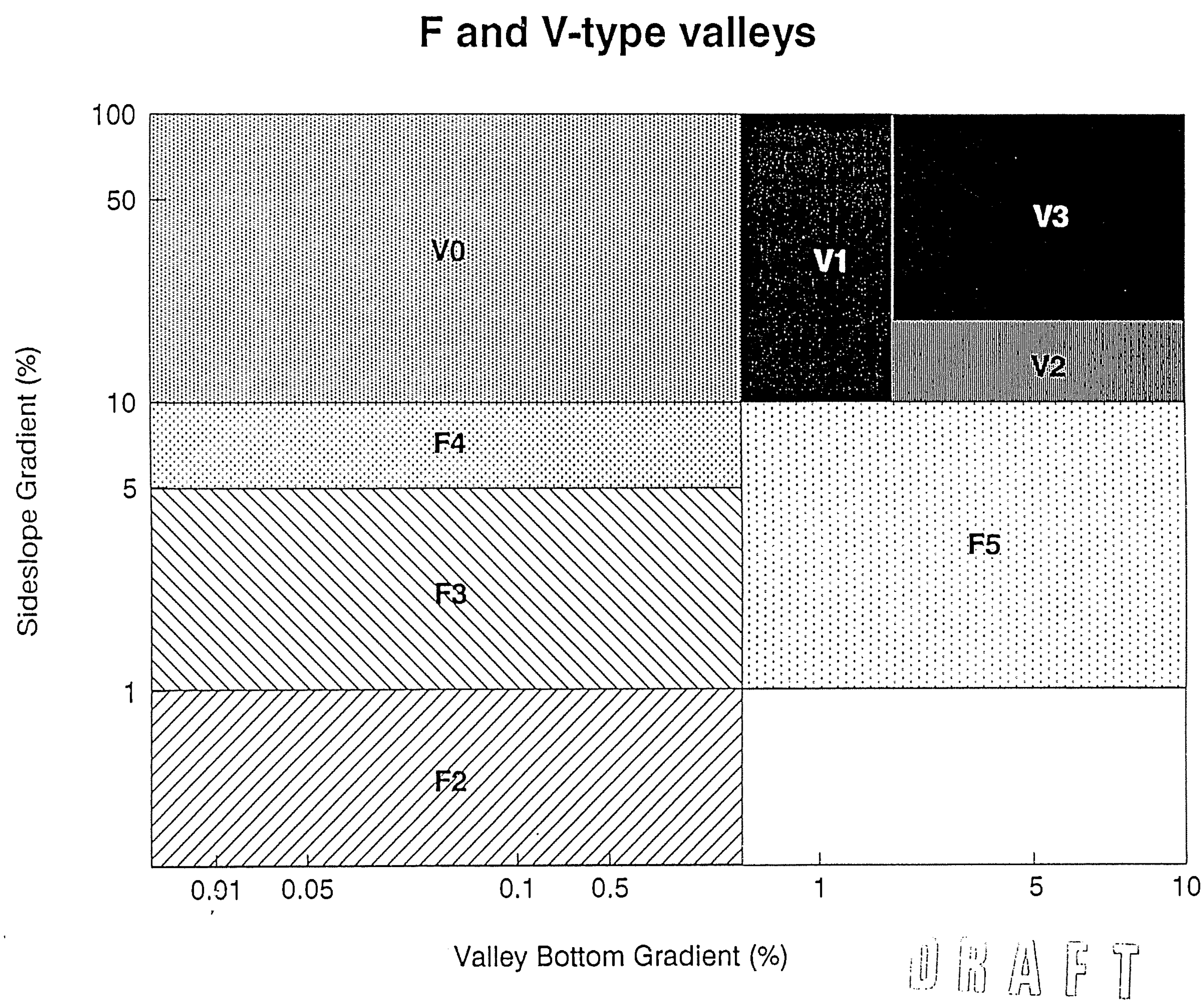

Figure 1. **Domains of F- and V-type valley bottoms in terms of the valley bottom gradient and the valley side gradient. Other variables considered in the determination of valley type are listed in Table 1.**

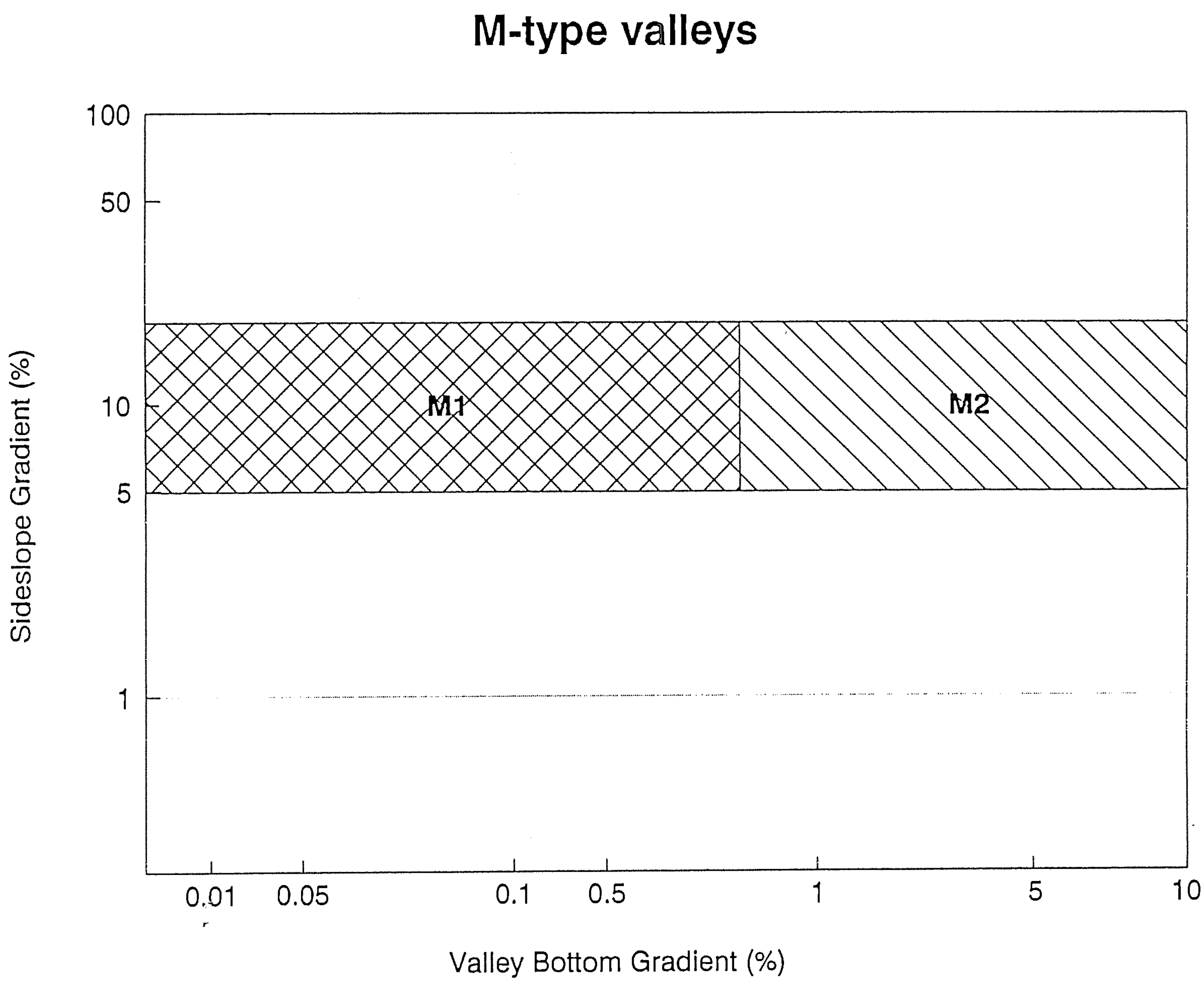

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Figure 2. **Domains of M-type valley bottoms in terms of the valley bottom gradient and the valley side gradient. Other variables considered in the determination of valley type are listed in Table 1.**

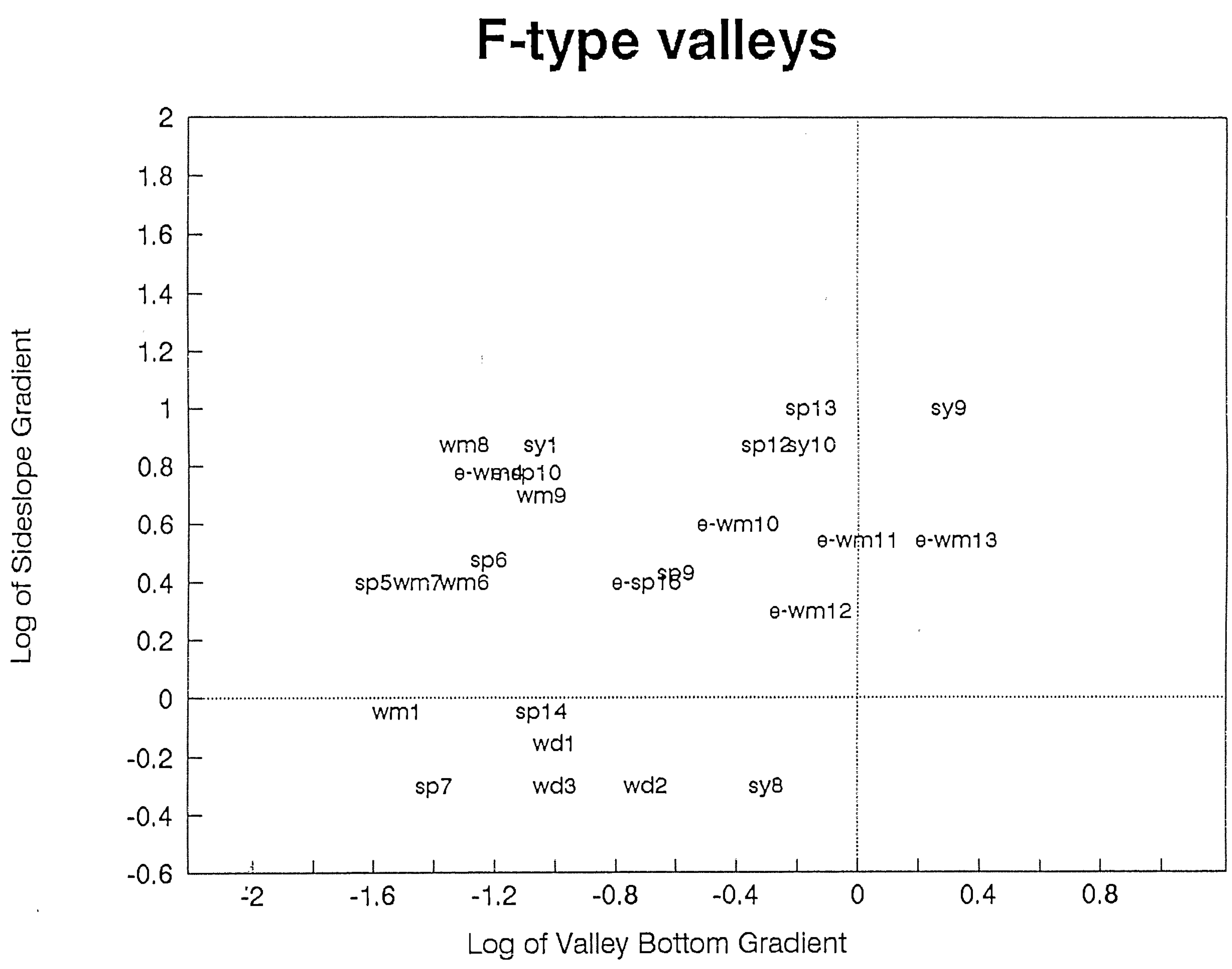

Figure 3. Plotting location of each site classified as F-type valleys.

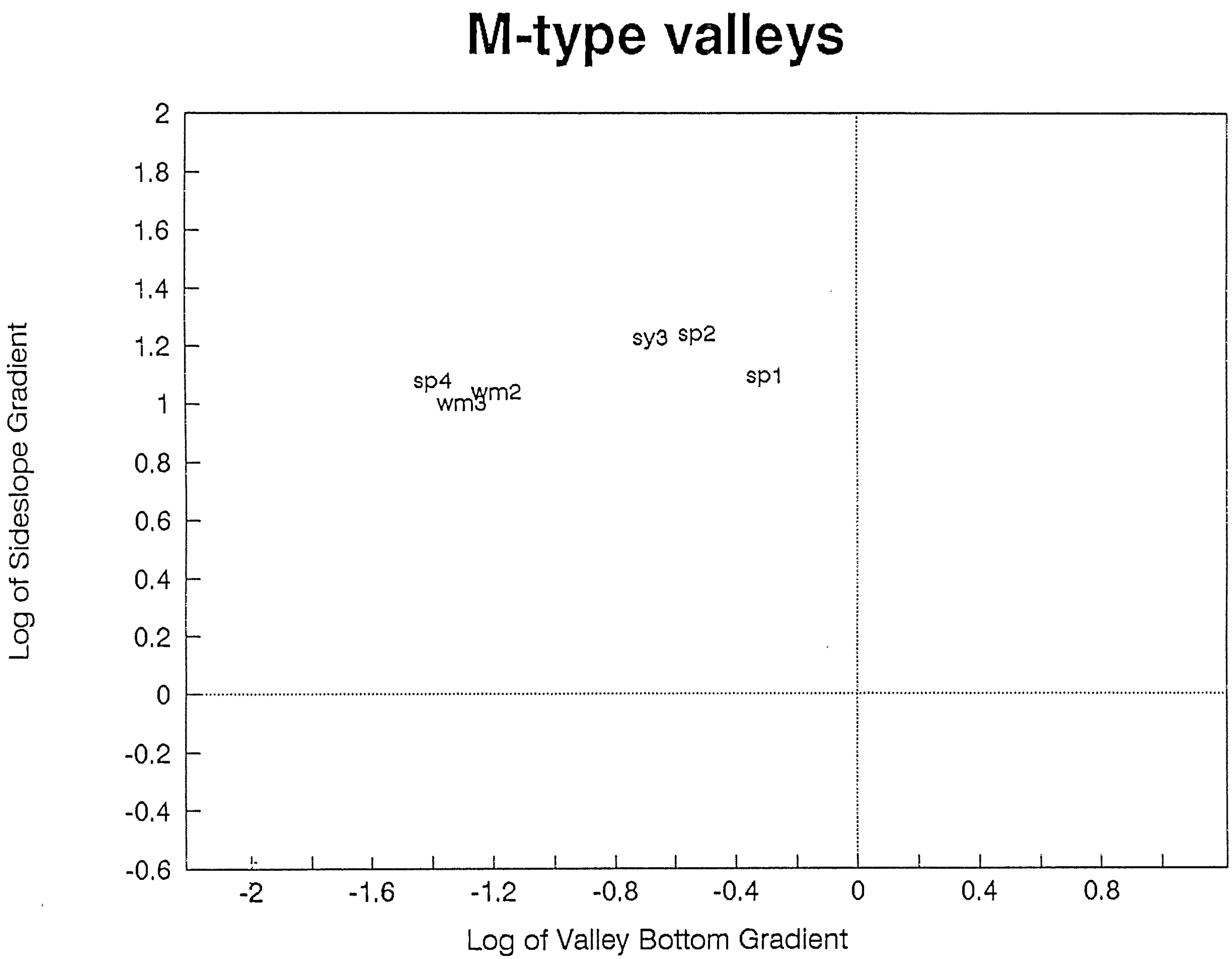

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Figure 4. **Plotting location of each site classified as M-type valley.**

V-type valleys

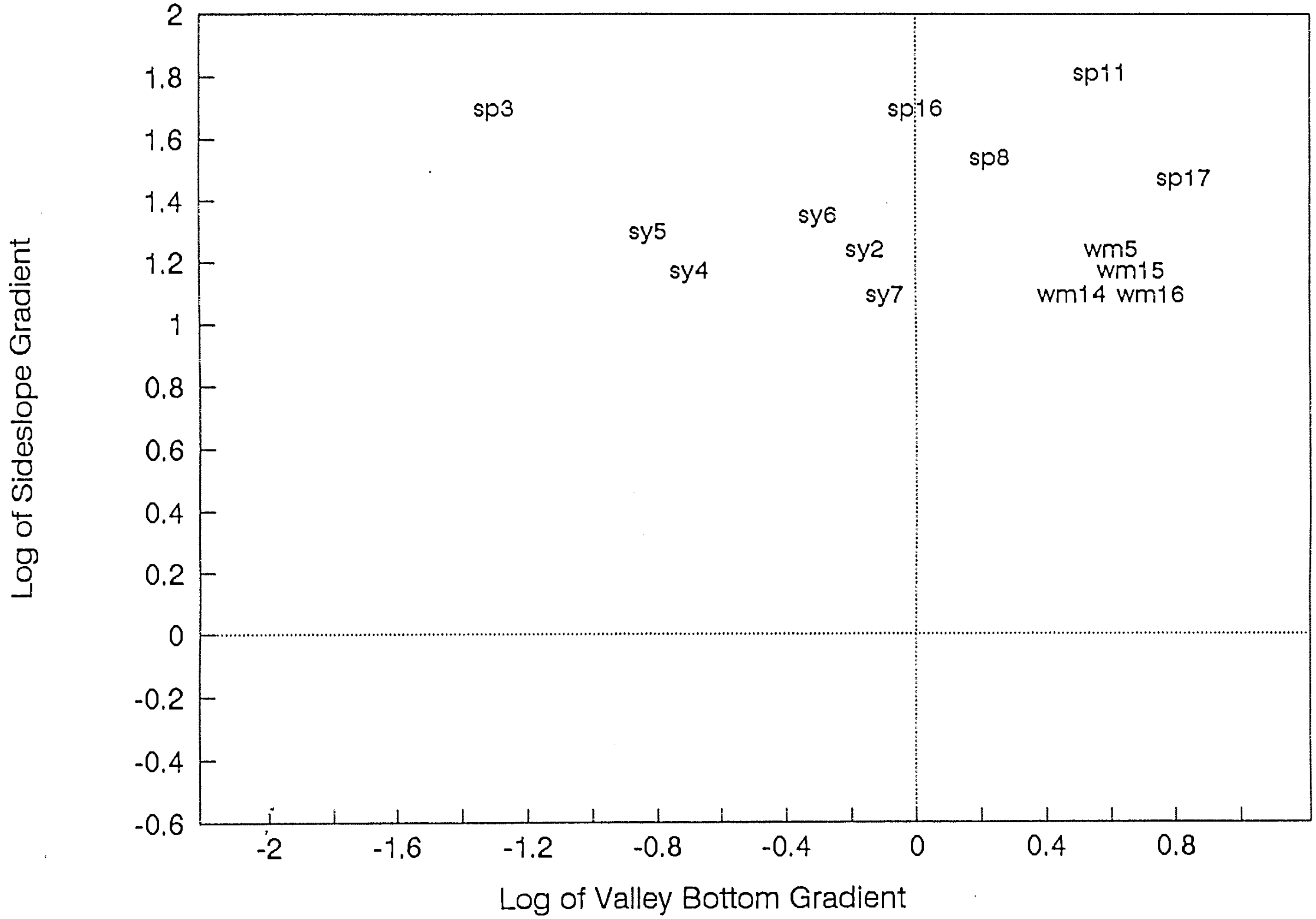

Figure 5. **Plotting location of each site classified as V-type valley.**