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Eightmile River Watershed Biodiversity Report



Prepared for the Eightmile River Wild and Scenic Study Committee

By

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EXECUTIVE SUMMARY

The Eightmile River watershed is a relatively undeveloped drainage basin that occupies 62.4 mi² of hilly, mostly forested terrain in southeastern Connecticut. In 2004, the author was commissioned by the Eightmile River Wild and Scenic Study Committee to: 1) assess the biodiversity values and significance of the Eightmile River watershed, especially with respect to imperiled plants and animals; 2) identify and document those physical, biological, and ecological elements that make the watershed exemplary and unique as an intact, functioning watershed ecosystem; 3) create maps depicting unique species and natural community/habitat resources; 4) identify and document anadromous and resident fish species; and 5) develop a set of management recommendations for the watershed. This study was commissioned in support of an anticipated application for Federal Wild & Scenic River designation for the entire watershed. The author, whose primary area of expertise and background is botany and classification of vegetation and natural communities, has researched existing information relevant to the biodiversity of the watershed, and presents it in this report.

The Eightmile River is a tributary to the lower Connecticut River. The confluence of the two rivers is approximately 8 miles from the mouth of the larger river at Long Island Sound (whence the Eightmile River reportedly gets its name), and the entire watershed is within ~18 miles of Long Island Sound. At the point of confluence, the Connecticut River and the downstream-most 2.4± miles of the Eightmile River are tidal with halinities close the boundary between freshwater (< 0.5 ppt) and oligohaline (0.5-5.0 ppt). Most of this tidal section the Eightmile River is a relatively long, narrow, shallow embayment of the Connecticut River known as Hamburg Cove. The Connecticut River is doubtless a dominant influence on ambient water levels and water chemistry of Hamburg Cove, except perhaps when the Eightmile River is in flood, and then for relatively short periods. However, the Eightmile River, by way of these relatively short periods of intense floods, is believed to be a prime factor resulting in the dominance of coarse sediments in Hamburg Cove, which in turn is a critical factor in the occurrence of species and communities of high biodiversity significance.

Beyond the tidally influenced sections, the Eightmile River and its major tributaries are clear, picturesque streams with long, mostly medium-high gradient, mostly forested sections punctuated by occasional small impoundments (man- and beaver-made) and occasional low-gradient shrub-swampy or marshy sections. The landscape of the watershed may be characterized overall as one of rolling, more or less irregular, low hills and ridges separated by numerous small, narrow drainage corridors and hollows, and in places broader valleys and basins. Ambient hill-top elevations gradually decrease across the watershed from 500-650 ft at the north end to 300-400 ft at the southern end. However, beyond these generalizations, there is considerable landscape-level geomorphologic variation within the watershed, and several geologic and geomorphologic features of the watershed have been recognized as exceptional in

various contexts. Among these features are an exceptional number of different bedrock types (Lundgren 1966), and the occurrence of a series of strike ridges whose east-west orientation is unique, in New England, to a small area in southeast Connecticut that includes the Eightmile watershed.

As the first step in the assessment of the biodiversity significance of the Eightmile River watershed, an inventory was completed of rare plants and wildlife known or believed to be extant in the watershed. This inventory drew in largest part on existing information, but it was also augmented by limited primary field survey by the author, focusing mainly on rare plants and natural communities. Important sources of existing information included the Connecticut Dept. of Environmental Protection's (CT-DEP) Wildlife and Fisheries Divisions, the CT-DEP Natural Diversity Data Base (NDDB, i.e., the state natural heritage program), scientists from area universities and other institutions, local naturalists, and a variety of published studies. Rare plants and wildlife were defined as species listed as "Endangered", "Threatened", or "Special Concern" under Connecticut's Endangered Species Act, species listed as "important", "very important", or "most important" in Connecticut's Comprehensive Wildlife Management Strategy, and other species identified as being of special conservation concern by other organizations, such as ICUN and the New England Wildflower Society. A total of 160 such species, referred to in this report as "at risk" species, are either known to be currently extant in the watershed, or documented recently enough (i.e., within the last 25 years) to suspect they are extant. This list is comprised of 37 vascular plants, 6 amphibians, 77 bird species, 11 fish species, 10 invertebrate species, 6 reptiles and turtles, and 13 mammals. The watershed hosts 5 globally rare species: two plants, *Bidens eatonii* Eaton's Beggar's-ticks (G2) and *Eriocaulon parkeri* Parker's Pipewort (G3), and three insects, *Callophrys irus* Frosted Elfin (G3, a butterfly), *Gomphus ventricosus* Skillet Clubtail (G3, a dragonfly), and *Enallagma minusculum* Little Bluet (G3G4, a damselfly). Also, the watershed is a breeding season and winter foraging area for one species listed as Threatened under the U. S. Endangered Species Act: the Bald Eagle. The Eightmile River watershed is the New England regional stronghold for two regionally rare plants, *Scutellaria integrifolia* Hyssop Skullcap and *Aristolochia serpentaria* Virginia Snakeroot, and the Connecticut stronghold for a third regionally rare plant, *Xyris smalliana* Small's Yellow-eyed Grass.

The biodiversity significance of the Eightmile River watershed was evaluated in two contexts: state and regional (with "regional" defined as New England) and using two measures of species rarity, state and global. Biodiversity significance may be defined in many ways, but for the purposes of this analysis, the number of extant rare species was considered to be a surrogate for high biodiversity significance. This approach was used because it is generally accepted that high densities of rare species are, more often than not, the "icing on the cake", i.e., rare species most often occur in places that have unusually high species (and natural community) richness. Using data compiled by NatureServe and originating with the six New England state natural heritage

programs, the Eightmile River watershed was compared to all other watersheds in New England, in terms of extant globally rare species (species ranked G1-G3 by NatureServe) and extant state-rarest species (species ranked S1-S2 by local heritage programs). Comparing numbers of extant rare species per unit area of watershed ("extant" being defined as having been observed within the last 25 years), the Eightmile River watershed ranks very high in both state and regional contexts. Due to differences between watershed/drainage basin classification systems at the state and federal level, a direct comparison was not possible. But a direct comparison of the two component HUC12 basins that comprise the Eightmile River watershed, the Eightmile River [mainstem] basin and the East Branch Eightmile River basin, was possible, and the two HUC12 basins rank in the 98th and 90th percentile, respectively, of the 1,931 HUC12 basins in New England in terms of total extant globally rare species per unit area, and in the 95th and 89th percentile, respectively, in terms of total extant combined state-rare and globally rare species per unit area.

The Eightmile River watershed's biodiversity significance in a state context was evaluated with the assistance of the Connecticut Department of Environmental Protection's Natural Diversity Data Base (CT-DEP-NDDDB), which is the state's natural heritage program. A direct comparison to Connecticut's other regional basins was possible, and for this comparison rare species were defined as all species listed as Endangered, Threatened, or Special Concern under the Connecticut's Endangered Species Act (this includes all globally rare species as well), as well as any other species assigned a state conservation status rank of S2S3 or lower. In this comparison, the Eightmile watershed, with 49 extant state-rare species (0.7853 spp/mi²), exceeds all but four of Connecticut's regional drainage basins, in terms of extant state-rare species per unit area. The four basins that exceed the Eightmile (the Wood, Tenmile, Hollenbeck, and Blackberry River basins) are in the two subregions of New England that have the highest numbers of extant rare species in New England: northwestern Connecticut and vicinity, and southwestern Rhode Island and vicinity.

That the Eightmile hosts a relatively high number of extant globally and state-rare species is a function largely of the existence in the watershed of intact special habitats/natural communities. As a general rule, the rarest species in any landscape are habitat specialists that are rare because their specialized habitats are rare. This certainly holds true for the Eightmile watershed, and the majority of its globally and state-rare species and other uncommon species are associated with special habitats and natural communities that cover relatively small portions of the watershed, such as freshwater and oligohaline intertidal habitats, medium fens, sandy and peaty shorelines of natural sandy-bottomed lakes, acidic and sweet seasonally wet meadows, acidic cliffs, rocky outcrops of interbedded amphibolite and marble, dry grasslands, xeric sand barrens, and Atlantic White Cedar swamps. Also, the majority (but not all) of rare and uncommon species hosted by the watershed are associated with non-forested habitats, some of which are naturally open (such as medium fens and intertidal sand-gravel flats), but many of which are open- or semi-open-

canopy habitats due to past or on-going manipulation by man.

An exceptional biodiversity feature of the Eightmile River watershed is the association of a high-profile “at risk” bird species, the Cerulean Warbler (*Dendroica cerulea*), with a forest habitat type, or complex of types, that is not itself rare, but occurs on an unusually large scale in the watershed. This neotropical migrant is not yet globally rare, but is in a rangewide decline that is believed to be due to fragmentation of large mature forest stands. The Eightmile watershed, throughout much of which the Cerulean Warbler breeds, comprises the greatest part of a regional stronghold for this species. This warbler is considered one of the most area-sensitive bird species (i.e., large unbroken mature forest blocks are required to support robust breeding populations), and it is believed that the Eightmile watershed’s robust breeding population is related to the size and types of its forest blocks in juxtaposition with the watershed’s near-coastal geographic position, and resulting relatively mild climate (the center of the Cerulean Warbler’s breeding range is the central Appalachians – it is reaching its northern range limit in New England). Thus, the existence of a large breeding population of Cerulean Warblers is evidence that the Eightmile River watershed has a unique combination of forest size, type, and geographic position.

This study approached the evaluation of river and watershed ecosystem quality by looking for indicators (biological, ecological, and physical) of ecosystem and habitat intactness and functioning. The above-mentioned Cerulean Warbler is one such biological indicator. Other important biological indicators identified were vernal-pool-dependant amphibians, such as Spotted Salamander and Wood Frog. Both species require a landscape with two habitat elements juxtaposed: sufficient densities of undegraded vernal pool habitat for breeding sites, and large, unfragmented accessible upland forest habitat for adult foraging. Both species are found throughout the Eightmile watershed, and populations are evidently very robust in many places. These robust populations are evidence of intact and functioning complex of habitat types.

Another important biological indicator in the watershed is stream macrobenthos (i.e., the communities of invertebrates that dwell on the bottoms of streams). The CT-DEP has sampled the Eightmile River and East Branch Eightmile River, and have concluded, based on the macrobenthic species assemblage present, that the Eightmile [mainstem] is essentially pristine, while the East Branch Eightmile River ranks in the upper half of sampling sites statewide, in terms of water and habitat quality.

Several landscape level indicators of habitat intactness were assessed and used to compare the Eightmile River watershed to other watersheds in a Connecticut context. These parameters were road miles/unit area of watershed (using GIS data from the CT-DEP’s Environmental and Geographic Information Center), the proportion of a watershed that is occupied by large roadless blocks (using a coverage developed by The Nature Conservancy), the total forested proportion of

the watershed, and the percent developed area of the watershed (using a land use coverage developed by University of Connecticut Center for Land Use Education and Research from 2002 satellite imagery). The Eightmile watershed, with 2.65 road miles/square mile of watershed, has the third lowest road miles/mi² of the 44 regional watersheds in CT (range: 1.57 to 16.5 road mi/mi²). The Eightmile watershed ranks 2nd from the top in terms of percentage of watershed occupied by roadless blocks of 1000 ac or greater (72.2% for the Eightmile watershed). Only two of Connecticut's 44 regional watersheds have a greater percentage of forested area than the Eightmile watershed. Of special note, in light of the above-discussed hypothesis regarding the large breeding population of Cerulean Warblers centered in the Eightmile watershed, is that it exceeds all other near-coastal Connecticut watersheds in percentage forested area, by 9 to 81 percentage points. Finally, the Eightmile watershed, with 6.74% developed land, has a lower percentage of developed area than all except four of Connecticut's 44 regional watersheds, and a lower percentage of developed land than all 15 other near-coastal watersheds. For all four landscape level parameters, the Eightmile watershed is either comparable to, or is exceeded only by, the four above-mentioned Connecticut watersheds that have the highest numbers of extant rare species in New England (the Wood, Tenmile, Hollenbeck, and Blackberry River basins).

In summary, the Eightmile River watershed ranks very high in a state and regional context in terms of biodiversity values and biodiversity significance. This is indicated by a high number of species identified as "at risk" by various conservation organizations, and it is indicated by the relatively high numbers of the subset of "at risk" species that are classified as globally rare and state-rare, compared with all other watersheds in Connecticut and New England. It is a unique regional stronghold for several specific rare/at risk species. In addition, in terms of a number of other parameters that are indicators of ecosystem integrity, intactness, and function, the Eightmile watershed is comparable to, or exceeded only by, a few watersheds in southern New England that have the largest concentrations of extant rare species in all of New England.

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Eightmile River watershed in a New England regional context: the NatureServe analysis

There are several ways in which the regional biodiversity significance of the Eightmile river watershed may be assessed. One way is to compare the number of rare species found in the Eightmile to other watersheds of comparable scale in the region. Toward this end, in late 2004, NatureServe.org was commissioned by the Eightmile Watershed Study Committee to create a tally of extant rare species for each of all the HUC12 and HUC10 drainage basins in New England. This analysis was a first of its kind, as it was based upon data shared by state natural heritage programs, and data sharing agreements between the natural heritage programs and NatureServe had only just been finalized by late 2004.

The species used in the analysis were only those currently considered the rarest in each state (species with state ranks of S2S3 or rarer), and all globally rare species (global rarity ranks of G3G4 or rarer). There were several reasons for this restriction, which eliminates from consideration many species that are legally protected in each state, and many other species that have been identified by various organizations as of conservation concern and at-risk. One reason for the restriction was to neutralize as much as possible the geographic scale differences between states that all use the same rarity ranking system, which is based mainly on numbers of known occurrences in the state. Another reason was the supposition that the state heritage programs have a more accurate understanding of true numbers of occurrences for their rarest species than for the less rare species, because the former have been the objects of greater inventory effort.

An additional restriction on the NatureServe analysis is that it counts only species documented in the watershed in the last 25 years. This represents a best attempt to compare, between watersheds, the number of extant rare species, and, by extension, existing habitat conditions (as opposed to historic conditions). The majority of records older than 25 years are problematic to use in this kind of analysis, because locality information is for most records too imprecise to allow assignment to watershed (town is most often the most precise locality information associated with older records).

Given these restrictions, the tally of extant countable rare species for the Eightmile River watershed was 20 species (including 3 globally rare species) before incorporating recent data not available to NatureServe at the time of the analysis, and the tally is 32 species (including 5 globally rare species), after incorporating the occurrence data developed by recent surveys and research in 2003-2005 (which data had not been processed by the state heritage program and transmitted to NatureServe by the time of there analysis). Both tallies are surprisingly small compared with the number of State-listed species (55), and the summary list of “at-risk” species associated with the watershed (160). However, this reduction is understandable, given the focus of this analysis on the rarest species, in a regional, rather than a state, context.

As explained in the introduction, the hierarchical scheme of organization of drainage basins used

by the federal government differs from that used by the state of Connecticut, and the other New England states use the federal system. For this reason, it is not possible to directly compare the tally of rare species for the Eightmile River watershed, as it is defined in this report, to the New England HUC12 and HUC10 drainage basins. The majority of New England's HUC10 (i.e., regional) basins are 2X to 9X the area of the Eightmile River watershed, while most HUC12 (subregional) basins are much smaller (median size = $\sim 31 \text{ mi}^2$). Comparisons of species richness among geographic units of very different area are biased toward the larger units, because species richness generally increases with area regardless of relative biodiversity values. However, the Eightmile River watershed is comprised of two federal HUC12 basins, and it was possible to directly compare each of these subsets of the Eightmile River watershed to all other HUC12 basins across New England. The results of this comparison are presented in Table 4. Also, a comparison has been made between the Eightmile watershed, as defined in this report, and all other New England HUC10 watersheds (median size = $\sim 137 \text{ mi}^2$), using density of rare species per unit area, which in some measure equalizes the "advantage" of the larger size watersheds. This comparison is presented in Table 5.

Table 4. Ranking of the two Eightmile River HUC12 basins among all New England and Connecticut HUC12 basins, in terms of extant rare species/basin and extant rare species/unit basin area in New England.					
	Eightmile [main stem]	Eightmile [main stem]	Eightmile [main stem]	East Branch Eightmile	East Branch Eightmile
	HUC12 code: 010802050903 (before updating data)	HUC12 code: 010802050903 (after updating data)	HUC12 code: 010802050902 (before updating data)	HUC12 code: 010802050902 (after updating data)	
Number extant <i>globally rare</i> species (G1 thru G2G3) in basin	3	5	0	1	
Number extant state-rare and globally rare species (S1 thru S2S3, G1 thru G2G3) in basin	19	25	2	7	
New England Context					
Number of HUC12 basins: 1931	2.1%	0.8%	26.8%	9.3%	
NE HUC12 basin area range: 0.03-265 mi ²	95.7%	98.9%	n/a	73.2%	
Median HUC12 basin area: 31 mi ²	96 th	98 th	n/a	90 th	
Extant total rare species/HUC12 basin: Range = 0-60; Median = 1	4.6%	2.7%	36.7%	16.4%	
Extant globally rare species/basin: Range = 0-13; Median = 0	95.0%	97.0%	54.4%	81.5%	
	94 th	95 th	67 th	89 th	
<p>Percentage of New England HUC12 basins hosting MORE extant <i>globally rare</i> species</p> <p>Percentage of New England HUC12 basins hosting FEWER extant <i>globally rare</i> species</p> <p>Percentile rank among New England HUC12 basins based on DENSITY of <i>globally rare</i> species (i.e., species/unit area of basin)</p> <p>Percentage of New England HUC12 basins hosting MORE extant total rare species (state-rare and globally rare combined)</p> <p>Percentage of New England HUC12 basins hosting FEWER extant rare species (state-rare and globally rare combined)</p> <p>Percentile rank among New England HUC12 basins based on DENSITY of MORE extant total rare species (state-rare and globally rare combined) (i.e., species/unit area of basin)</p>					

Table 5. Comparison of Eightmile River watershed to HUC10 watersheds in New England and Connecticut, in terms of rare species/unit area.

		Eightmile River watershed (=Eightmile [main stem]) HUC12 code: 010802050903 + East Branch Eightmile HUC12 code: 010802050902), before updating data.	Eightmile River watershed (=Eightmile [main stem]) HUC12 code: 010802050903 + East Branch Eightmile HUC12 code: 010802050902), after updating data.
Number extant <i>globally rare species</i> (G1 thru G2G3) in basin		3	5
Number extant state-rare and globally rare species (S1 thru S2S3, G1 thru G2G3) in basin		20	31
New England Context Number of HUC10 basins: 417 Median HUC10 basin area: ~137 mi ² Extant total rare species/HUC10 basin: Range = 0-112; Median = 8 Extant globally rare species/basin: Range = 0-20; Median = 1	Percentage of New England HUC10 basins hosting MORE extant <i>globally rare species</i> /square mile	8.6%	1.1%
	Percentage of New England HUC10 basins hosting FEWER extant <i>globally rare species</i> /square mile	91.4%	98.9%
	Percentage of New England HUC10 basins hosting MORE extant total rare species (state-rare and globally rare combined)/square mile	9.4%	4.6%
	Percentage of New England HUC10 basins hosting FEWER extant rare species (state-rare and globally rare combined)/square mile	90.6%	95.4%

To summarize the data presented in Tables 4 and 5, the Eightmile River watershed, as defined for this report, ranks among the New England regional (HUC10) and subregional (HUC12) basins with the highest concentrations of extant rare species, regardless of the several ways in which the comparison may be made. When the Eightmile watershed is ranked among the 417 New England HUC10 basins in terms of number of extant rare species per unit basin area, it ranks in the 96th percentile in terms of extant total rare species/unit basin area, and in the 99th percentile, in terms of extant globally rare species/unit basin area. In an alternative comparison of basins more similar in terms of area, the two component HUC12 basins comprising the Eightmile watershed have been ranked among the 1,931 New England HUC12 basins, in terms of extant rare species/basin. The Eightmile [main stem] basin is exceeded by only 2.7% of New England basins in terms of total extant rare species/basin, and is exceeded by only 0.8% of New England HUC12 basins, in terms of extant globally rare species/basin. The East Branch Eightmile basin is exceeded by 19.2% of New England HUC12 basins, in terms of total rare species per basin, and by 37.4% of New England HUC12 basins, in terms of extant globally rare species per basin.

The evident difference between the rare species richness of Eightmile [main stem] HUC12 basin and the East Branch Eightmile HUC12 basin is in part real, due to the several ecological systems present in the former and not in the latter. However, in part it is an artifact of the much smaller size of the East Branch basin (22.5 mi²), compared with the Eightmile main stem (39.9 mi²), the majority of New England HUC12 basins (median size = 31 mi²). If the one attempts to neutralize the effect of area disparity by using *density* of rare species, the East Branch HUC12 basin ranks in the 90th percentile of New England HUC12 basins, in terms of extant globally rare species/unit basin area, and in the 89th percentile of New England HUC12 basins, in terms of total extant rare species/unit basin area.

Eightmile River watershed in a Connecticut context

In a state context, the biodiversity significance of the Eightmile watershed may be directly compared to the other regional drainage basins, using the CT-DEP organizational scheme, wherein the Eightmile watershed is defined as Regional basin No. 48. In this section, the Eightmile watershed is ranked against other Connecticut regional basins in terms of numbers of globally rare species and numbers of total rare species (i.e., state-rare plus globally rare species). A tally of extant globally rare species for each Connecticut regional drainage basin is presented in Table 6. Extant globally rare species are defined in the same way as in the previous section. Tallies were provided by the CT-DEP-NDDDB in May 2005, and thus are more current, by almost one year, than the data used to generate the Natureserve New England tallies in the previous section

Table 6. Comparison of the Eightmile watershed to other Connecticut regional basins, in terms of number of extant1 globally rare and State-rare2 species per basin (regional basins listed in order of highest to lowest density of globally rare species per basin).

CT Regional Basin No.	CT Regional Basin	CT Area (sq mi)	No. of Extant Globally Rare Species	Density extant globally rare species (no. spp./mi2 of basin)	No. of total extant rare species (globally and State-rare combined)	Density total extant rare species (no. spp./mi2 of basin)
n/a	Long Island Sound	n/a	5	n/a		
11	Wood	10.2	2	0.1961	10	0.9851
63	Tenmile	35.7	4	0.1120	53	1.4843
62	Hollenbeck	42.9	4	0.0932	84	1.9580
61	Blackberry	34.4	3	0.0872	56	1.6279
48	Eightmile	62.4	5	0.0801	49	0.7853
41	Stony Brook	35.7	2	0.0560	15	0.4200
36	Pachaug	61.6	3	0.0487	36	0.5843
20	Southeast Shoreline	42.8	2	0.0467	41	0.9887
35	Moosup	48.6	2	0.0412	10	0.2056
34	Fivemile	51.9	2	0.0385	11	0.2119
50	South Central Shoreline	58.5	2	0.0342	36	0.6262
60	Housatonic Main Stem	402.3	13	0.0323	168	0.4176
38	Shetucket	124.9	4	0.0320	20	0.1601
40	Connecticut Main Stem	387.6	12	0.0310	130	0.3354
53	South Central Western Complex	104.8	3	0.0286	32	0.3053
32	Natchaug	175.4	5	0.0285	33	0.1882
66	Still	70.7	2	0.0283	38	0.5373

Table 6. Comparison of the Eightmile watershed to other Connecticut regional basins, in terms of number of extant1 globally rare and State-rare2 species per basin (regional basins listed in order of highest to lowest density of globally rare species per basin).

CT Regional Basin No.	CT Regional Basin	CT Area (sq mi)	No. of Extant Globally Rare Species	Density extant globally rare species (no. spp./mi2 of basin)	No. of total extant rare species (globally and State-rare combined)	Density total extant rare species (no. spp./mi2 of basin)
52	Quinnipiac	165.5	4	0.0242	61	0.3685
70	Southwest Shoreline	41.4	1	0.0242	27	0.7211
72	Saugatuck	89.5	2	0.0223	34	0.3800
47	Salmon	149	3	0.0201	28	0.1879
73	Norwalk	58.3	1	0.0172	10	0.1717
51	South Central Eastern Complex	182.7	3	0.0164	74	0.4050
31	Willimantic	219.1	3	0.0137	24	0.1095
42	Scantic	83.2	1	0.0120	10	0.1203
37	Quinebaug	256.3	3	0.0117	25	0.0975
43	Farmington	451	5	0.0111	109	0.2417
71	Southwest Eastern	98.6	1	0.0101	32	0.3245
30	Thames Main Stem	107.7	1	0.0093	22	0.2045
69	Naugatuck	311.2	1	0.0032	36	0.1157
65	Aspetuck	50.7	0	0.0000	5	0.0985
64	Candlewood	39.0	0	0.0000	7	0.1794
81	Croton	21.1	0	0.0000	5	0.2374
33	French	17.1	0	0.0000	1	0.0586
45	Hockanum	77.1	0	0.0000	12	0.1556

Table 6. Comparison of the Eightmile watershed to other Connecticut regional basins, in terms of number of extant1 globally rare and State-rare2 species per basin (regional basins listed in order of highest to lowest density of globally rare species per basin).

CT Regional Basin No.	CT Regional Basin	CT Area (sq mi)	No. of Extant Globally Rare Species	Density extant globally rare species (no. spp./mi2 of basin)	No. of total extant rare species (globally and State-rare combined)	Density total extant rare species (no. spp./mi2 of basin)
46	Mattabasset	108.9	0	0.0000	38	0.3489
44	Park	77.2	0	0.0000	8	0.1036
10	Pawcatuck Main Stem	47.0	0	0.0000	17	0.3617
68	Pomperaug	89.0	0	0.0000	32	0.3596
67	Shepaug	155.4	0	0.0000	40	0.2573
21	Southeast Eastern Complex	62.4	0	0.0000	27	0.4328
22	Southeast Western Complex	58.2	0	0.0000	11	0.1891
74	Southwest Western Complex	104.3	0	0.0000	13	0.1246
39	Yantic	97.8	0	0.0000	1	0.0102
	Mean	112.9	2.3	0.0275	34.8	0.4133
	Median	77.2	2.0	0.0168	27.5	0.2813
	Maximum	451	13	0.1961	168	1.9580
	Minimum	10.2	0	0.0000	1	0.0102

Source: CT-DEP-NDDB June 2005

1"extant" here means that species has been documented in the basin within the last 25 years, and it is not known to have been extirpated since the last observation

2for this analysis, "State-rare" species are defined as all species listed pursuant to Connecticut's Endangered Species Act (i.e., "State-listed"), plus any species that are not State-listed that have S-ranks of S2S3 or rarer

The data presented in Table 6 shows that the Eightmile watershed, which hosts populations of five globally rare species, ranks in the top 6 of the 44 regional basins in Connecticut, in terms of number of extant globally rare species per basin. Only two regional basins exceed the Eightmile in the number of extant globally rare species/basin, while four basins have the same number. A straight comparison of species tallies of regional basins in Connecticut means comparing geographic entities of very different area, and such comparisons are potentially biased in favor of the entities with larger area, independent of the biodiversity values of the entities. Thus, a more informative comparison may be that of density of globally rare species per basin. In terms of number of extant globally rare species per unit area of basin, the Eightmile watershed (0.0801/mi²) ranks 5th among the 44 Connecticut regional watersheds. In terms of total extant rare species (globally rare plus State-rare species) per unit area of watershed, the Eightmile watershed ranks 6th in Connecticut. The five watersheds with with higher rare plant densities are all watershes with the highest rare species densities in New England.



FRIENDS OF WANGUM VALLEY OUR MISSION

We are a group of Falls Village residents who live on or near Barnes Road, Canaan Mountain Road, Cobble Road, or Under Mountain Road. Some of us are full-time residents and some are part-time residents. We have come together in our appreciation of the beauty and heritage of Wangum Valley and the southern escarpment of Canaan Mountain that overlooks the valley. Through this valley flows Wangum Brook from its source on Canaan Mountain, part of the last and largest remaining unfragmented wilderness area in Connecticut. This land extends east/northeast along Barnes Road from South Canaan and southeast from Route 7 along Under Mountain Road to Route 63.

We share a concern that the undeveloped character of this area, that we all cherish and want to protect, could be adversely altered unless careful thought and planning are given to this area's future. To more effectively act upon our concern and realize our vision for the area, we have formed an association, the Friends of Wangum Valley. Simply stated, our mission is to serve as spokespersons for the following goals:

To work to preserve the beauty and rural character of the area, being mindful of the need to keep the land open to productive uses;

To maintain a good working relationship with the broader Falls Village community and its leadership;

To facilitate appropriate opportunities for all to appreciate this area's natural beauty, with respect for the land's ecological value and its rural, undeveloped character;

To support development which is in keeping with the nature of the area and consistent with the economic needs of Falls Village;

To promote sound land-stewardship practices within this area, which can include sustainable agriculture;

To work with state, local, and private entities involved in natural resource conservation as relates to this area.

We welcome the participation of all who share these goals.

August, 2003

1W82

Gale Courey Toensing *Republican-American*

Chris Wood, the Nature Conservancy's director of the Sunny Valley Preserve, visits the 182-acre parcel in Falls Village which was purchased Friday by the conservation group. He's pointing out a downy woodpecker that landed

on the bare branches of a maple tree by the Hollenbeck River, which runs along the east boundary of the property. The land will be held as a nature preserve, open to the public for hiking and other recreational activities.

Conservation group returns land to nature

Conservancy buys site in Falls Village

By Gale Courey Toensing

© 1995 *Republican-American*

FALLS VILLAGE — The Nature Conservancy Connecticut Chapter has purchased a parcel of wetlands, forest and grasslands on Page Road and Route 7, creating a new 182-acre preserve.

The land was bought Friday for \$136,000 from Edmund H. Dean of Falls Village and his sisters, Mildred D. Marshall and Mafred D. Allyn of North Canaan. Money from the Conservancy's land preservation fund were used for the purchase.

The property is a biologically significant site that provides habitat for several species of plants and animals, some of which may be on the endangered or threatened list, said Carolyn K. Evans, director of land protection.

"The Conservancy will perform a complete inventory next spring and develop a management plan based on its findings," Evans said.

A trail system will be constructed on the land, which will be open to the public for hiking and other educational and recreational activities that will not disturb the plant and animal species.

Susan Kelsey, chairwoman of the Falls Village Conservation Commission, applauded the project.

"Open space is one of the most important assets our town has to offer," Kelsey said. "I feel fortunate

that organizations such as the Conservancy exist, in order to help guarantee the continued existence of these open spaces."

The land contains a swamp area wooded with a mix of red maple, black ash, white pine and hemlock trees that cover about 85 acres. The Hollenbeck River, which defines the east boundary, flows north and then west to the Housatonic River, running through Robbins Swamp, the largest inland wetland in the state. The limestone base beneath the soil encourages and supports rare species.

"It's a gorgeous piece of land. It's got everything we want," Evans said.

The Conservancy wants not only to protect plant and animals species already on the land, but also to attract rare species, such as grasshopper sparrows.

"I'd like to see the sedge wren, which is extremely rare in Connecticut, find a home here," said Chris Wood, director of the Sunny Valley Preserve. "If we allow the sedges and rushes in the wet soil by the river to grow for two or three years, the sedge wren may return."

The Nature Conservancy is an international, private, non-profit organization dedicated to the preservation of plants, animals, and natural communities through the protection of the land and water. The Conservancy also owns some land in Robbins Swamp abutting the railroad and a few areas on Canaan Mountain.

1W83

AFFIDAVIT OF BONNIE BURDICK

State of Connecticut)
) ss.: *Canaan*
County of Litchfield)

Bonnie Burdick being duly sworn deposes and says:

1. My name is Bonnie Burdick. I live at 180 Johnson Road, Falls Village, Connecticut, a short distance from Cobble Hill and the proposed cell tower site under Docket 409.
2. This is our family home and farm. We purchased our house in 1979. We chose to live here and raise our two children here because of the rural beauty of the area, pristine vistas, and the abundant wildlife.
3. From our house and house lot we will see the proposed cell tower under Docket 409. See picture #1.
4. We own the farm on the north side of Johnson Road (195 Johnson Road).
5. We will see from our farm and fields the proposed cell tower under Docket 409. See picture #2.
6. These properties were not listed in the application to the Siting Council (Docket 409) as properties with views of the proposed tower.
7. I ask that the Connecticut Siting Council accept my affidavit and the attached exhibits into evidence for consideration under Docket 409, as it is material to the application. I ask that the Siting Council deny the application. I offer to make myself available at the Council's convenience if the Council should have any questions.

Bonnie Burdick

Bonnie Burdick

Sworn to before me
This 9th day of February, 2011

Mary M. Palmer

Notary Public

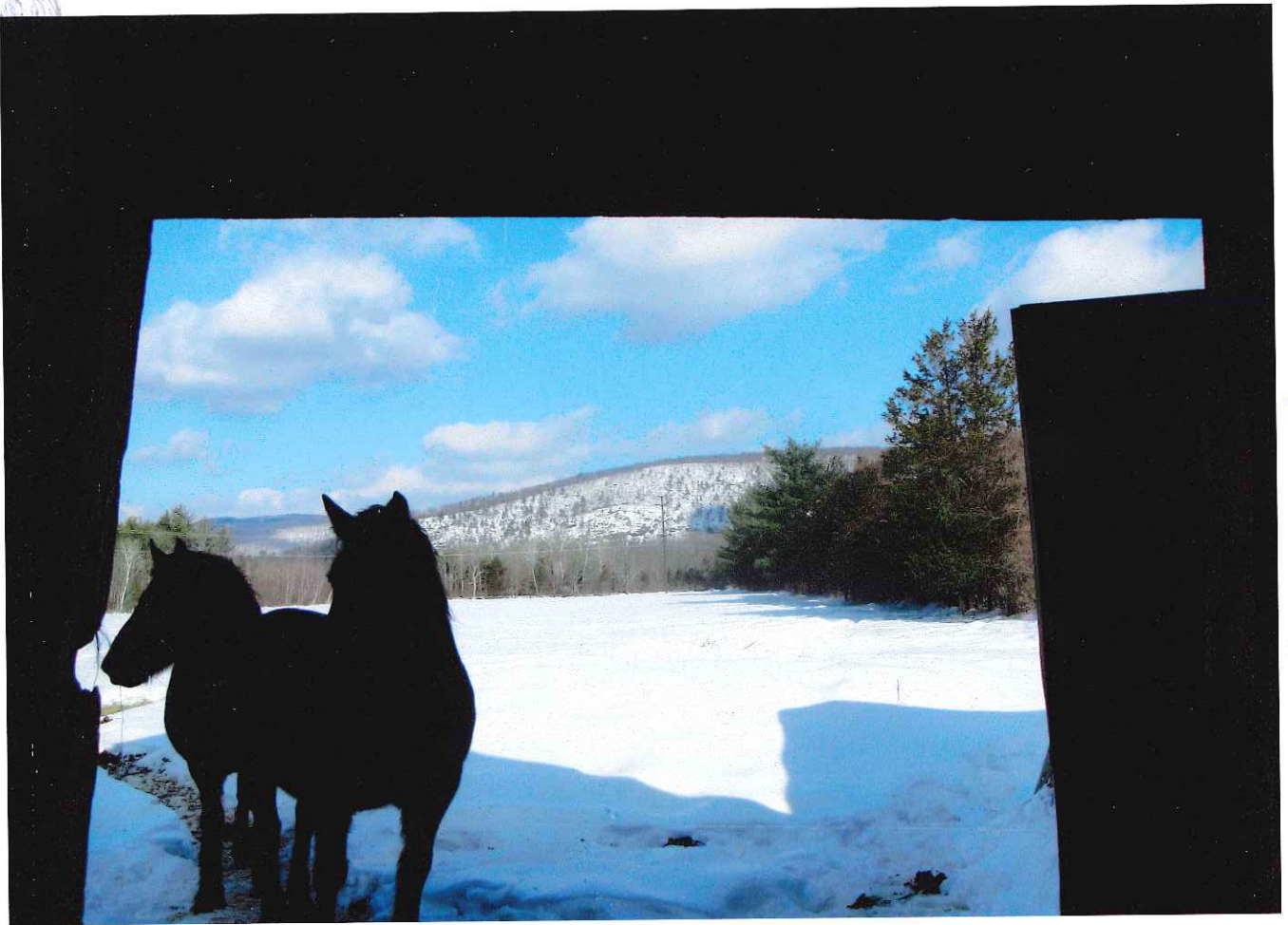
MARY M. PALMER
Notary Public
My Commission Expires April 30, 2011



close-up
of #1



#1



#2



Close-up
of #
2

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In two communities in Nagano Prefecture an increasing number of citizens are complaining of swollen lymph glands and muscle pain, and at the same time deformities are appearing in plants. The causes have not been clarified, but some people suspect that the electromagnetic waves from mobile phone base stations may be a factor.

Author:

Ms. A (40) of Ina City began suffering from headaches, fatigue and eye pain in 2002. Her condition gradually worsened, and when she was at home, while studying for a skills qualification exam, she found herself unable to concentrate, had a hard time remembering, and had attacks of dizziness.

Title:

Keyword:

Last year unusual changes she had never seen before in the plants in her garden began to appear.

Search



Captions: Left to right

Shirotsukemusa with a fasciated stem extending from the center of a flower. Another flower blooms at the tip of the extended stem.

Five or six cosmos flowers appeared with the disk flower (the yellow center part) turning petal-like. Photographed in October 2004.

A tulip with one leaf aggrandized. Photographed approximately 300 meters from the DoCoMo Base Station. From left to right, bottom:



Captions: Left to right

Narcissuses with a mixture of split and not split corolla. Approximately 300 meters from the DoCoMo Base Station.

Dandelion with abnormally fat stems and more than one flower on each stem. The B family first observed four years ago, and it has reappeared every year since.

Near the B family, a mutation was observed this spring on butterbur flowers. The stems, fasciated, are stuck together half way down.

At the same time, at the home of Mr. B (44), who lives in the town of Takaou, some 25 kilometers from Ina, the health of family members deteriorated. They experienced unusual symptoms for the first time, things like chronic exhaustion, itching hands and feet, and a sudden rise in blood pressure to double their normal levels. And many of the dandelions in his garden developed fasciation, an abnormal thickening of the stem.

Besides the strange phenomena seen in plants and the deterioration in peoples' health, these two communities have something else in common. Mobile phone base stations were built in both communities a year before the oddities occurred. A Vodafone base station is located about 200 meters from A's house, and an NTT base station is about 250 meters from B's house.

Eyesight deterioration, swelling of lymph glands

Electromagnetic waves from mobile phones are thought to damage cells and cause diseases like leukemia and brain tumor, but they also seem to cause more commonplace health problems.

According to a survey by the Applied National Science Laboratory in France, more people living near mobile phone base stations have health problems than people not exposed to mobile phone electromagnetic waves. And women suffer particularly from headaches, nausea and poor appetite.

Research by the Dutch Economic Ministry points out that electromagnetic waves from third generation mobile phones (3G) may cause headaches and nausea. When irradiated with electromagnetic waves of the same strength as those of 3G, the number of people who complained of headaches and nausea was considerably greater than those exposed to electromagnetic waves from previous types of mobile phones.

Ms. A, suspecting that the electromagnetic waves from mobile phones might be the cause of the deformed plants and her health problems, conducted a survey of 30 people living within 300 meters of the Vodafone base station.

The findings revealed that 20 per cent of residents suffered deteriorating eyesight after the mobile phone base station was built. As many as 16 per cent complained of swollen lymph glands in the neck and underarms, and muscle pain. And 13 per cent experienced declines in their ability to think, concentrate and remember. Furthermore, 13 percent reported having noticed unusual phenomena in the flowers and vegetables growing nearby.

1. The high frequency electromagnetic waves in Ms. A and Mr. B's homes measure maximums of between 0.1375 and 0.717 microwatts per square centimeter (a unit that shows the quantity of heat passing through 1 square centimeter). Is this a safe level for an everyday life environment?

Permissible levels for mobile phone electromagnetic waves are set very high in

Japan, at 600 and 1000 microwatts per square centimeter (differing with the frequency band).

But the city of Salzburg in Austria has much tougher standards (0.1 microwatts per square centimeter), and in Paris, France a stiff standard has been set of an average over 24 hours of 1.06 microwatts per square centimeter. The prevalence of stone houses in Europe, moreover, means that levels are probably lower indoors there. Some researchers think that levels should be set even lower, such as at 0.00002 microwatts per square centimeter. (Note 1)

Aware of the possibility of damage to health from exposure to even low doses over long periods of time, Ms. A and others put up shield cloth over the windows and wall of their houses on the side of the mobile phone base station to block the electromagnetic waves. She found that her symptoms were clearly lessened in the room with shield cloth and her fatigue and palpitations alleviated. Using a high frequency measurement instrument, she found the level decreased more than 94 per cent (Note 2)

Deformed plants nationwide?

A TV Asahi program, "Super Morning", reported that fasciation in dandelions was on the rise throughout the country, and that it was thought that seeds might be being produced that were sensitive to chemical substances as a result of increased crossbreeding between Western dandelions and Japanese dandelions. But in Ina and Takaou irregularities are occurring in plants other than dandelions, and there are more species with irregularities every year.



In an organic farm 180 meters from the mobile phonestation, a cucumber was found with a leaf growing out of the fruit.

According to Professor Yamamoto Kotaro, who is studying plant morphology function at Hokkaido University, "there is a gene that suppresses the area of the growth point at the apex of the stem that makes the stem, but when that gene is destroyed the fasciation that thickens the stem occurs." He adds that "a flower is basically a leaf that has evolved, so that when the gene that transforms a leaf into a flower is destroyed the flower reverts to a leaf. Unusual phenomena like the mutation of a stamen into a petal or of a petal into a calyx can also easily occur."

The influence of agricultural chemicals and other chemical substances and of electromagnetic waves are usually thought to be behind such genetic irregularities. But at the homes in Nagano where the strange modifications in plants and humans are occurring, agricultural chemicals have not been used for nearly ten years, and one family has been raising vegetables the traditional, chemical-free way for fifty-five years.

In nature, sudden abnormalities in plants can occur due to cosmic rays, but in the case of seed-bearing plants such abnormalities are believed to occur at a rate of only 1 in 100,000.

Fasciation and stamens becoming petals are occurring in many of the plants around Ms. A's house, plants like cosmos, daffodils, Dutch clover, bergamots, poppy anemones. Without surveying the whole area, it is not possible to give an accurate estimate of the rate of occurrence of these abnormalities, but they would seem to be occurring at a rate higher than 1 in 100,000.

Also, for example, a maple in Ms. A's yard grew a whole meter last summer. An umbrella pine, a species that normally grows 10 centimeters a year, grew 25 centimeters last year, and as of June this year, had already grown 10 centimeters. And a castor aralia grew 95 centimeters this spring alone.

There is not much research on the relationship between electromagnetic waves and plants, but a study by the University of Michigan of trees located between 50 and 150 meters of a Navy communications antenna that emits ultralow frequency electromagnetic waves revealed that the growth of maples increased by 74 per cent. One theory is that radiation may cause an increase in the absorption rate of carbon dioxide. Another is that electromagnetic waves hasten plant growth.

The environment in which we live has changed enormously in the last fifty years. Man-made electromagnetic waves have drastically increased as has pollution from chemicals. A combination of these factors may be giving rise to changes in plants and animals, humans included.

Notes

1. Ogino Koya. Puroburemu Q&A, abunai keitai denwa [Problem Q&A: dangerous electromagnetic waves], Ryokufu Shuppan.

2. The high frequency instrument used measures not only mobile phone electromagnetic waves but also electromagnetic waves from TV and radio high frequency bands. It measures the electrical field and converts it into power density

This article appeared in Shukan Kinyobi, July 2, 2004, pp. 27-29. Kato Yasuko is a freelance journalist specializing in electromagnetic wave pollution and health issues. Posted at Japan Focus on December 15, 2004.

Translated for Japan Focus by Jean Inglis, a translator, and citrus grower living in Hiroshima prefecture.