Landscape Ecosystem (Geoecosystem) Classification,
Green Mountains western slope, lower-slope ice-contact landscape
Colby Hill Ecological Project, Lincoln and Bristol, Vermont
Identified, classified, described and mapped by Marc Lapin

GREEN MOUNTAIN LOWER WEST SLOPE
ICE-CONTACT TERRAIN
ABLATION TILL (ICE-CONTACT DEPOSITS/WASHED TILL)
DEEP MINERAL SOILS--UPLANDS
*Mesic Forests on Level to Steeply Sloping*[1]*, Well Drained to Moderately Well Drained, Deep, Coarse-Loamy Soils*
*"Forests on Deep Soils with Unimpeded Drainage"*

South, West and Northwest Aspects on Steep Slopes

1. WELL DRAINED, STEEPLY SLOPING, FINE SANDY LOAM SPODOSOL, BEECH-MAPLE-RED OAK-SWEET BIRCH FOREST *(Mesic Red Oak-Hardwood Forest)*[2] (Berkshire soil series)

Physiography: Lower elevation, steep slopes, south to northwest aspects.
Soils: A horizon 2-10cm brown fine sandy loam, E horizon 0-3cm gray sandy loam, Bs horizon bright orangey-red, deep fine sandy loam.
Vegetation: A diverse tree canopy, including sugar and red maples, beech, white ash, red oak, sweet and yellow birches, hemlock, white pine and red pine. Understory dominated by beech. Small trees include hophornbeam, striped maple and witch-hazel; shrubs include maple-leaved viburnum, hobblebush, and alternate-leaved dogwood. Common herbs include Canada mayflower, Christmas fern, marginal wood-fern, starflower, sessile-leaved bellwort, white wood aster, partridgeberry, New York fern, Indian cucumber-root, stiff clubmoss and pink lady's-slipper.
Comments: The tree and shrub flora indicate the warmer microclimate of the south and west slopes. Red oak is co-dominant with beech and red maple. The co-dominance of red maple is perhaps related to the logging history of the site. The herb species richness and herb coverage are both noticeably less extensive than in the richer, moister ecosystems. The color of the Bs horizon is brighter, more yellow-orange than in other ecosystems. Red pine occurs in a limited area on a steep, south slope; every red pine has been marked by bear scratches.

North and East Aspects, or Slope less than Steep

2. WELL DRAINED, GENTLY TO MODERATELY SLOPING, FINE SANDY LOAM OVER (STONY) FINE SANDY LOAM SPODOSOL, NORTHERN HARDWOOD FOREST *(Northern Hardwood Forest)* (Berkshire soil series)

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1 Slope categories: Level 0-2%, Gently sloping 3-8%, Moderately sloping 9-20%, Steeply sloping 21-40%, Very steeply sloping 41-80%

2 Parenthetical names in italics are the nearest equivalent natural community as described in Thompson, E and E. Sorenson. 2000. Wetland Woodland, Wildland: Natural communities of Vermont. TNC (VT chapter) and VT Department of Fish and Wildlife, Waterbury, VT.

Physiography: Gentle to moderate slopes, all aspects.
Soils: A horizon 2-6cm, dark brown, loam or fine sandy loam, E horizon typically absent, Bs horizon deep, stony loam to fine sandy loam, reddish-brown to medium brown. Where there is a plow layer, the A horizon may extend 30cm deep. pH throughout the B horizon is typically 5.0-5.6.
Vegetation: Dominant and co-dominant trees are sugar maple, red maple, yellow birch and American beech, although in some of the old-field forest, these species have not yet entered the canopy, nor the understory in some places. The younger stands contain high percentages of white pine and red maple, with a mix of trembling aspen and paper birch. The understory may contain hophornbeam and striped maple. Shrubs occur in low coverages, but the shrub flora needs better documentation. Ferns are common in the herb layer; common species are intermediate wood-fern, lady fern, New York fern, and hay-scented fern in younger and more recently disturbed stands. Forbs include Canada mayflower, goldthread, starflower, partridgeberry and slender sedge; short-husk grass is common in patches.
Comments: This ecosystem type may be thought of as the "average" ablation till ecosystem, without any significant "altering" physiographic or soil characteristics, such as steep slope, north or south aspect, or slowed soil drainage. Forest structure varies considerably due to successional and management history. In general, the forest has an immature to mid-successional structure; that is, it lacks well developed stratification characteristic of mature northern hardwood forests. Often the overstory and sapling layers are developed, while the understory stratum is absent. The herb layer is often heavily dominated by ferns, with forb coverage and abundance substantially less than in the richer northern hardwood ecosystems. The number of herb species is also less in this hardwood forest ecosystem than in the richer and moister hardwood types. In the southeast corner of the property, a formerly cultivated area of the ecosystem type has a high percentage of red spruce in the overstory, perhaps due landscape position between two ecosystems that provide a spruce seed source. The herb and shrub layers here include several species that indicate higher fertility than the norm--alternate-leaved dogwood, peduncled sedge, loose sedge and blue cohosh. In the north part of the property, adjacent to the rich, seepy slope, the line between this ecosystem and ecosystem 12 has not been mapped and is only an approximation. Ecosystem type 12 differs in having mottles and a hardpan in the subsoil, and typically an herb layer with a greater cover of the robust, more moisture-demanding, interrupted and sensitive ferns.

3. WELL TO MODERATELY WELL DRAINED, NORTH ASPECT, MODERATELY TO STEEPLY SLOPING, (FINE SANDY) LOAM OVER STONY LOAM SPODOSOL, NORTHERN HARDWOOD FOREST *(Northern Hardwood Forest)*

Physiography: Moderate to steep slopes, north and northeast aspects.
Soils: A horizon 3-10cm brown fine sandy loam, Bs horizon deep (to ~30cm) medium brown to dark reddish brown fine sandy loam, common medium mottles at ~30cm.
Vegetation: Overstory trees are yellow birch, sugar maple, red maple, and less commonly white ash and butternut. Hemlock, hophornbeam and sugar maple are common in the understory. Common herbs in this ecosystem are lady, interrupted, cinnamon and sensitive ferns, intermediate wood-fern, foamflower, sweet bedstraw, jack-in-the-pulpit, starflower, Canada mayflower, partridgeberry, peduncled and slender sedges, and rarely golden ragwort; the creeping shrub dwarf raspberry is also common.

Comments: Similar to ecosystem type 12, but on steeper slopes and without a well developed hardpan. The north slope tends to be very seepy, as in ecosystem type 6, and due to both seepiness and insolation/evapotranspiration it is moister than other aspects. Although richness indicators do occur in this ecosystem type, it is not, overall, a rich-woods type. The soil appears to be intermediate between ecosystem types 2 (Berkshire series) and 12 (Peru series). The A horizon is deeper and moister than in type 2, and the B horizon is less reddish and more towards medium brown, but there is no hardpan as there is in type 12. Given appropriate sampling, statistical analysis might not show this ecosystem type to differ significantly from type 12 or 6, for it has some characteristics of each. For now it is left as a separate ecosystem type. Areas of it that were heavily pastured, the more moderately sloping areas, have come back to white pine, red maple and aspens.

4. MODERATELY WELL DRAINED, GENTLY TO MODERATELY SLOPING, SILT LOAM OVER STONY FINE SANDY LOAM INCEPTISOL, SUGAR MAPLE-WHITE ASH NORTHERN HARDWOOD FOREST *(Sugar Maple-White Ash Northern Hardwood Forest)* (Amenia soil series)

Physiography: Gentle to moderate slopes, (north aspect), areas with some post-glacial alluvial influence (greater than average deposition of silt) such as headwater "draw" of a permanent tributary stream.
Soil: A horizon 20-35cm dark brown silt loam, B horizon medium brown cobbly or stony loam to silt loam, common prominent mottles at ~40cm in the B/C horizon of stony sandy loam.
Vegetation: Sugar maple and white ash dominant; associates include yellow birch, red maple, red spruce, black cherry and American elm. Young successional areas have tamarack, white pine, gray birch, balsam fir, trembling aspen and pin cherry. Dominant herbs are lady fern, interrupted fern, New York fern, sensitive fern, cinnamon fern, water avens and slender sedge.
Comments: The ecosystem is likely highly productive, and parts were formerly cultivated fields; the lack of pit-and-mound microtopography is indicative of tilling. Soil fertility is indicated by pH measurements of 5.6-6.0 in the A and B horizons. The lack of accumulated leaf litter, and therefore the abundance of bare soil, are another indication of high fertility as expressed by rapid decomposition and mixing which lead to a relatively deep A horizon. Most of the forest of this ecosystem type is too young to reveal the full complement of potential vegetation and the stature of the trees, but a non-cultivated area features numerous straight, tall white ash. Scattered cobbles are common on the surface.

5. MODERATELY WELL DRAINED, MEDIUM SANDY LOAM SPODOSOL, NORTHERN HARDWOOD-RED MAPLE-RED SPRUCE FOREST *(Spruce-Fir-Northern Hardwood Forest)* (Sunapee soil series)

Physiography: Narrow flat-topped ridge, elevated slightly (e.g. less than one meter) above the adjacent basal till.
Soil: A horizon 7-15cm deep brown to medium brown fine sandy loam, E horizon 0-5cm gray (fine) sandy loam, Bhs horizon 0-5cm dark reddish brown (fine) sandy loam, Bs horizon minimum 25cm thick and in some places to 50cm or more thick reddish brown sandy loam, C horizon sandy loam, few faint mottles may begin at 40cm, mottles often absent in the top 80cm.
Vegetation: The vegetation is typical of moist, acid, sandy soils. The trees are red maple, red spruce, beech, yellow birch, and where the B horizons extend deeper and lack any mottling, a

substantial amount of black cherry and sugar maple. The herbs are a relatively low diversity assemblage of Canada mayflower, goldthread, starflower, Indian cucumber-root, shining clubmoss, painted trillium, bluebead lily, intermediate wood-fern, Christmas fern and hay-scented fern.
Comments: Physiography well defines the ecosystem type. The soil profile is diagnostic also, with a fairly uniform sandy loam texture throughout the profile and classic spodosol horizonation and coloring. The A is darker brown and generally deeper than in ecosystem type 2; the Bs is more brightly colored than in ecosystem types 12 and 14, and browner than in ecosystem type 2; the profile either lacks a hardpan or has only an incipient hardpan. Vegetatively, the abundance of Canada mayflower and the presence of painted trillium are informative. The overstory trees vary somewhat from north to south, but the well-developed sandy spodosol soil continues in a band from the south property boundary to the open wetland in the middle of the parcel.

SHALLOW MINERAL SOILS--UPLANDS

*Dry-Mesic to Mesic Forests on Moderately to Steeply Sloping, Somewhat Excessively Drained to Moderately Well Drained, Shallow-to-Bedrock, Loamy Soils*

*"Forests on Shallow Soils"*

Forests on Nutrient-enriched Soils

Seepy Terrain

6. RICH, MODERATELY WELL DRAINED, STEEPLY TO VERY STEEPLY SLOPING, SEEPY, LOAM OVER FINE SANDY LOAM SPODOSOL, NORTHERN HARDWOOD FOREST *(Rich Northern Hardwood Forest)*

Physiography: Steep to very steep slopes, north aspect, smooth slab outcrops on the upper slope, numerous parallel streams (both intermittent and permanent) give the slope broadly corrugated shape.
Soil: A horizon 10-20cm black loam high in organic matter, Bs 15-40cm dark reddish brown loam, B/C and C stony loam. In seeps, mottling is present at approximately 60cm. Soil depth varies from upper to lower slope, with the upper slope featuring shallower soils and outcrops and the lower slope having approximately 80cm soil above bedrock. The slab outcrops are moist and have a thin organic soil veneer.
Vegetation: Sugar maple, yellow birch, white ash, red oak, beech, butternut, paper birch, black cherry and red maple all occur in the overstory. The understory consists of sugar maple, beech and striped maple. The herb flora responds dramatically to the pattern of seeps and general terrain. Richness is apparent throughout the slope. Typical seep herbs are blue cohosh, wood-nettle, maidenhair fern, wild leek, ostrich fern, touch-me-not and golden saxifrage. Dominant herbs in general are plaintain-leaved sedge, blue cohosh, lady fern, New York fern, wakerobin, silvery spleenwort, white wood aster, intermediate wood-fern and Christmas fern. Many other species are present also.
Comments: The ecosystem type is one representative of several rich-seepy northern hardwood forest types; such ecosystems appear to be more common on north and east slopes in the northern Green Mountains, but ecologically they have more to do with lithology and hydrology than with aspect. The soil features a notably black and deep A horizon. The tree canopy is diverse and trees 25-35cm dbh dominate, but many individuals measure 38-45cm dbh. Some of the larger trees are white ash--56cm dbh, red oak--51cm, butternut--46cm, sugar maple--46cm. A cored 56cm white

ash was found to be approximately 65 years old. Herb coverage is high, and the forest has nicely developed stratification of overstory and understory trees, saplings and tall shrubs, low shrubs and herbs. There is a fair amount of deadwood on the forest floor. Relatively recent tip-ups are numerous, and, as is now common throughout its range, canker has infected the butternut, and they are commonly dead and standing.

Not Seepy Terrain

7. RICH, WELL TO SOMEWHAT EXCESSIVELY WELL DRAINED, BEDROCK KNOLL, STONY LOAM INCEPTISOL, NORTHERN HARDWOOD FOREST *(Transition Hardwoods Limestone Forest)* (Farmington soil series?)

Physiography: Outcropping bedrock knolls of Forestdale dolomite and limestone, level knoll-tops to very steeply sloping sides, all aspects.
Soil: Shallow profile, much exposed rock; needs to be described.
Vegetation: Trees include sugar maple, white ash, butternut, basswood, black cherry and American elm. Hophornbeam is abundant in the understory. Mountain maple and red raspberry are common shrubs. Herb species include lady fern, blue cohosh, enchanter's-nightshade, Dutchman's breeches, squirrel-corn, yellow violet, wild ginger, trout lily, bulblet bladder fern, white trillium, two-leaved mitrewort, large-flowered bellwort, zig-zag and bluestem goldenrods, herb-robert, dwarf enchanter's-nightshade, wild leek, nodding fescue, jack-in-the-pulpit, sharp-lobed hepatica, fragile fern, marginal wood-fern, maidenhair spleenwort, and many others.
Comments: The ecosystem type is clustered in a linear band demarcating the narrow zone of the limy bedrock type. The affinities with the limestone-bedrock ecosystems of the Champlain thrust fault are marked. The spring wildflower bloom is a sight to behold in this ecosystem type. Atop the largest ledge is a shallow-soil, dry forest of red oak, red maple and white pine, with white ash, hemlock and hophornbeam. Early low blueberry is common, and the herb species are few, in stark contrast to the rich ledge below--wild strawberry, Canada mayflower, poverty grass, marginal wood-fern, rough-leaved rice-grass, wild sarsaparilla and partridgeberry are present.

Forests on Average Soils

Not Seepy Terrain

8. WELL DRAINED, VERY STEEPLY SLOPING, RAVINE-BOTTOM, LOAM SPODOSOL, HEMLOCK FOREST *(Hemlock Forest)*

Physiography: Very steep lower slope, north aspect, adjacent to floor of gorge.
Soils: need description
Vegetation: The forest is hemlock-dominated, with white ash and yellow birch as associates. The understory is primarily hemlock saplings and the sparse ground-cover is composed nearly entirely of the following ferns: marginal and intermediate wood-ferns, Christmas fern, narrow beech-fern and oak fern.
Comments: Slopes are greater than 45% and as much as 78%. Hemlock, casting deep shade and creating very acidic soil, controls the vegetation. Average diameter of hemlock is approximately 40cm, the largest trees measure to 76cm dbh. Charcoal was detected in the soil in two locations.

9. SOMEWHAT EXCESSIVELY DRAINED, ACID KNOLL, FINE SANDY LOAM SPODOSOL, RED MAPLE-RED OAK-RED SPRUCE FOREST *(Northern Hardwood Forest)* (Lyman soil series)

Physiography: Outcropping bedrock knolls of Pinnacle formation schistose graywacke and Underhill formation schist and phyllite, level-topped to steeply sloping sides.
Soils: A horizon fine sandy loam, Bs horizon orangey-red fine sandy loam, Rock at 30cm to approximately 100cm.
Vegetation: Trees include red spruce, red maple, red oak, paper birch and bigtooth aspen. Spruce saplings are common. Common herbs include hay-scented fern, Canada mayflower, wild sarsaparilla, intermediate wood-fern, northern ground-cedar and rock polypody.
Comments: The flora of the ledgy, acid-knoll ecosystem is species poor in comparison to surrounding ecosystems. The soil is very shallow; in some spots pavement outcrop lies just beneath a thin layer of leaf litter. An accumulation of red spruce is very characteristic of the ecosystem, and where it adjoins ecosystem type 2, the presence of overstory spruce or common spruce saplings seems to be a very good predictor of soil depth.

## COARSE ALLUVIAL SOILS--RIPARIAN ECOSYSTEMS

*Wet-mesic Forests on Level, Moderately Well Drained, Extremely Stony, Deep, Coarse-Loamy Soils*

10. MODERATELY WELL DRAINED, LEVEL, EXTREMELY STONY SANDY LOAM (INCEPTISOL?), SMALL-STREAM RIPARIAN, YELLOW BIRCH-SUGAR MAPLE-WHITE ASH FOREST *(no correlate)*
Undifferentiated unit of 1) Sand, gravel, cobble stream floodplain, and 2) adjacent saturated, mucky, level, seepage forests.

Physiography: Level stream floodplains and adjacent seepage zones, 2-20m wide.
Soil: Of two types, 1) cobbly, gravelly sandy loam with little profile development, 2) A horizon saturated black muck or mucky silt loam, C horizon sandy loam.
Vegetation: Cobble-gravel areas: yellow birch, white ash, trembling aspen, sugar maple, black cherry and hophornbeam are the common trees, with a wide array of herbs including scabrous sedge, tall meadow-rue, zig-zag goldenrod, false hellebore, ostrich fern, New York fern, wild leek, silvery spleenwort, bottlebrush grass and maidenhair fern. Mucky seepage areas: yellow birch, red maple and balsam fir dominate; hobblebush and beaked hazel form a well developed shrub layer. The herbs are mostly tall and robust, such as northeastern mannagrass, interrupted fern, sensitive fern, lady fern and scabrous sedge.
Comments: There are actually two distinctive ecosystem types here; they are easilv identified on the ground, but occur in very close association and are both generally very narrow and restricted by hydrologic conditions. Therefore, they were not mapped separately at this time. These are very common ecosystem types in the Green Mountains, but are rarely defined as separate, distinctive entities that differ in composition, structure and function from the upland forest matrix. Riparian ecosystems serve very important functions for fauna, for they provide abundant herbaceous food resources, as well as microhabitats of importance to smaller vertebrates and invertebrates.

11. MODERATELY WELL DRAINED, LEVEL, EXTREMELY STONY SANDY LOAM (INCEPTISOL?), HIGH-ENERGY-STREAM RIPARIAN, YELLOW BIRCH-AMERICAN ELM-COTTONWOOD FOREST, *(no correlate)*

Physiography: Level floodplain flats scattered along the length of mid-size, high-gradient mountain streams.
Soil: Cobbly, gravelly sandy loam with little profile development; needs description.
Vegetation: Yellow birch is the dominant tree, with American elm and cottonwood as associates, and perhaps others (e.g. white ash, trembling aspen). Shrubs may be in dense patches; mountain and striped maples are common. Herbs include intermediate wood-fern, Christmas fern, lady fern, sensitive fern, jack-in-the-pulpit and water avens. The moss *Rhytidiadelphis* cf. *triquetrus* grows on the exposed sand, gravel and cobbles.
Comments: This ecosystem type, like type 10, is small and restricted, but occurs commonly throughout the Green Mountains. Since only a tiny patch of it occurs in the study area, it has not been well described. It differs from type 10 by much, much more dynamic hydrologic and disturbance regimes and probably therefore in other ecological processes as well.

BASAL TILL (DENSE, COMPACT TILL)
DEEP SOILS--UPLANDS
*Mesic to Wet-mesic Forests on Level to Gently Sloping, Well Drained to Somewhat Poorly Drained, Coarse-Loamy Soils, Hardpans at less than 1 meter*
*"Forests on Deep Soils with Impeded Drainage"*

12. MODERATELY WELL DRAINED, GENTLY TO MODERATELY SLOPING, FINE SANDY LOAM SPODOSOL, NORTHERN HARDWOOD FOREST *(Northern Hardwood Forest, or Yellow Birch-Northern Hardwood Forest)* (Peru soil series)

Physiography: Gentle to moderate slopes, north and east aspects, or in small "hollows" surrounded by somewhat elevated terrain.
Soils: A horizon 10-40cm dark brown loam to fine sandy loam, Bs horizon dark brown to reddish brown loam to fine sandy loam, hardpan at approximately 40-50cm with abundant, prominent red mottles beginning in the hardpan or slightly above.
Vegetation: Trees include yellow birch, sugar and red maples, white ash, black cherry, and in younger areas paper birch and trembling aspen. The small tree musclewood is rather diagnostic of this ecosystem type. Understory red spruce and balsam fir may be present. Beaked hazel is the only common erect shrub; the creeping shrub dwarf raspberry may be common. The herb layer is dominated by moisture-loving species such as interrupted, cinnamon, and sensitive ferns, and water avens. Other species include jack-in-the-pulpit, New York, lady and oak ferns, two-leaved toothwort, foamflower, slender sedge and weak sedge.
Comments: By physiography, soil and vegetation, this unit is intermediate between ecosystem type 2 and ecosystem type 14. Type 2 is better drained and lacks prominent mottles; type 14 is wetter and, although mottling may begin at the same depth, the B horizon in type 14 is neither as deep nor as clearly a Bs as in type 12. Where type 12 adjoins either of these two types, careful mapping is required to delineate the ecosystems. If one doubts that these three ecosystems differ substantially, look at the old field-lines marked by fences and walls. The original farmers typically cultivated type 12, but used types 2 and 14 as pasture. Surely this tells us something

about differences in ecosystem structure and productivity. The field lines very often coincide with ecosystem boundaries. From a vegetation perspective, the tall ferns and black cherry and white ash are abundant to common in this ecosystem type. Blowdowns are common in both ecosystem types 12 and 14. Most of this type is in mid-successional status.

13. MODERATELY WELL DRAINED TO SOMEWHAT POORLY DRAINED, GENTLY SLOPING, MUCKY LOAM OVER SANDY LOAM (INCEPTISOL?), NORTHERN HARDWOOD-HEMLOCK FOREST *(Hemlock-Yellow Birch Forest)*

Physiography: gentle toeslope, north-northeast aspect.
Soil: A horizon 20-30cm black mucky loam, B horizon thin to nonexistent, Cd horizon very cemented sandy loam, abundant prominent mottles at ~30cm.
Vegetation: Overstory trees are sugar maple, yellow birch, hemlock and red maple. Understory is primarily saplings of sugar maple and white ash, along with hophornbeam. The herbaceous flora is fern-dominated, by interrupted, sensitive and lady ferns; the sedge *Carex gynandra* is also common.
Comments: Ecosystem 13 is similar to ecosystems 12 and 14, but it has a very different physiography, in the toeslope of a steep slope; therefore, an input of moisture and nutrients from downslope flow is an important process. Related to that, the A horizon is moister and muckier than in the other two similar ecosystem types. Only a small portion of type 13 occurs on the property, and this may be indicative of the overall distribution of such toeslopes in the landscape.

14. SOMEWHAT POORLY DRAINED, GENTLY SLOPING, STONY SILT LOAM TO FINE SANDY LOAM INCEPTISOL, RED SPRUCE-BALSAM FIR-HEMLOCK-YELLOW BIRCH FOREST *(Spruce-Fir-Northern Hardwood Forest)* (Cabot soil series)

Physiography: gentle slope, west aspect in the study area, but probably in general on all aspects, well-developed pit-and-mound microtopography.
Soil: A horizon 20-35cm very dark brown fine sandy loam to silt loam, B horizon 5-10cm (brown?) medium to very fine sandy loam, Cd horizon olivey gray-brown, abundant prominent to medium reddish mottles at ~25-40cm.
Vegetation: A diverse mix of tree species including red spruce, balsam fir, yellow birch, red maple, hemlock and white ash comprise the overstory; beech is uncommon and sugar maple even less so. Massive, dead-standing American elms remain well distributed throughout. Hophornbeam is common on the higher mounds. Shrubs, such as red raspberry, meadowsweet, and dwarf raspberry, are common. The herb flora is diverse and includes intermediate wood-fern, lady, New York, sensitive, long-beech and Christmas ferns, slender sedge, foamflower, sharp-lobed hepatica, dwarf enchanter's-nightshade and peduncled sedge. In wet depressions species such as wrinkled goldenrod, spotted touch-me-not, marsh bedstraw, drooping wood-reed, skullcap, fowl-mannagrass and virgin's-bower are common.
Comments: This is the largest, basal-till ecosystem at the site. It is characterized by impeded drainage and pronounced hummock-hollow microtopography. Some areas were cultivated and now feature early successional species such as trembling aspen, balsam poplar, white pine, apple and hawthorn. The mowed fields are likely either this ecosystem type or type 12. Ecosystems 14 and 17 are closely related in many respects, and they interfinger on the ground. Type 17 has a muckier, saturated A horizon, and a shallower water table, for it receives downslope flow from

type 14 and also contains many groundwater seepages. There are many overlaps in vegetation, but ecosystem type 17 has greater abundances of balsam fir, sensitive fern, dwarf raspberry, bladder sedge, swamp saxifrage, two-seeded sedge and two-leaved mitrewort. One can notice the exposed tree roots in the wetter ecosystem type 17, and moss cover is greater, with *Thuidium delicatulum* and *Rhytidiadelphis* cf. *triquetrus* common. The overstories, however, are much the same. In ecosystem 14, blowdown is a common occurrence. A sampling of ages suggests that tree growth is rapid--51cm white pine--38 years; 61cm white ash stump--56 years; 38cm red spruce--70 years; 36cm trembling aspen--35 years. Age data from other ecosystems are needed to compare tree productivity. Moose utilization of this ecosystem type appears fairly constant, as evidenced by scat, track and browsing.

## SHALLOW ORGANIC OVER DEEP MINERAL SOILS--WETLANDS/HYDRIC ECOSYSTEMS

*Hydric Forests, Woodlands and Shrublands on Level to Moderately Sloping, Poorly Drained to Very Poorly Drained, Shallow Organic over Mineral Soils "Wetlands"*

### 15. POORLY DRAINED, GENTLY TO MODERATELY SLOPING, MUCKY SILT LOAM TO LOAM OVER FINE SANDY LOAM INCEPTISOL, YELLOW BIRCH-RED MAPLE-(TREMBLING ASPEN) FOREST SEEP *(no correlate)*

Physiography: level to moderate slope, north and northeast aspects, active groundwater seepage.
Soil: A horizon 30-40cm black mucky loam to silt loam, Cd horizon very fine to fine sandy loam, abundant bright reddish mottles @30-40cm.
Vegetation: The overstory is dominated by yellow birch and red maple, with substantial amounts of white pine, white ash and trembling aspen dependent upon successional history. In the understory, hophornbeam may occur on mounds and musclewood may be common. Herbaceous flora typically abounds with robust wetland herbs such as cinnamon, interrupted, sensitive and ostrich ferns. Lady fern is also common. Forbs include foamflower, water avens, false hellebore, and jack-in-the-pulpit. In a richer microsite, maidenhair fern, silvery glade-fern, peduncled sedge and blue cohosh also occur. The creeping wetland shrub, dwarf raspberry, is common.
Comments: This is an ecosystem type of small, poorly drained pockets of seepage forest within a matrix of either moderately well drained or well drained deciduous forest ecosystems. It has similarities to types 14 and 17, but does not include a coniferous component, or at the most contains a small percentage of red spruce. The tree flora difference may have to do with landscape position and patch size, with relation to seed source of the coniferous species (red spruce, hemlock, balsam fir). The richer variation of this ecosystem type is very much like type 6, and even adjoins it, but it is on a more moderate slope and has a hardpan, rather than shallow, subsoil. The hardpan acts hydrologically very much like bedrock, and therefore, the rich variation may, upon further investigation, better be considered as ecosystem type 6 than ecosystem type 15.

16. POORLY DRAINED, MODERATELY TO STEEPLY SLOPING, MUCKY SILT LOAM OVER FINE SANDY LOAM INCEPTISOL, BALSAM POPLAR-TREMBLING ASPEN-HARDWOOD SAPLINGS-WILLOW OPEN/WOODLAND SEEP *(no correlate)* (Peacham Soil Series?)

Physiography: Moderate to steep slopes, north aspect, active groundwater seepage.
Soil: A horizon ~60cm mucky silt, C horizon fine sand to fine sandy loam.
Vegetation: Trees and shrubs occur as scattered individuals and in clusters; many species establish in the seep, but most species die at young ages. Woody plants include balsam poplar, trembling aspen, willow, American elm, red maple, red oak, white pine, white ash, red spruce, tamarack, sugar maple, and European buckthorn. Ferns and sedges dominate the vegetation; common species are cinnamon, interrupted and sensitive ferns, common horsetail, water avens, golden ragwort and the sedges, *Carex stipata* and *C. gynandra.*
Comments: Only one example of this ecosystem type occurs at the study site. Field experience suggests that it is not common in the Green Mountains. The upper boundary is well defined by a short, steep slope; the lower end narrows into an organized, permanent stream. Vegetative differences between the upper and lower portions are noticeable and could be characterized. It is likely that cattle had access to the seep, and their influence on the current condition of the ecosystem is unknown. Hydrologic and soil information suggest, however, that the vegetation truly has a woodland physiognomy, rather than currently appearing as woodland due to disturbance from livestock.

17. POORLY DRAINED, LEVEL, MUCKY SILT LOAM OVER STONY (VERY) FINE SANDY LOAM INCEPTISOL, HEMLOCK-YELLOW BIRCH-RED MAPLE-BALSAM FIR-WHITE ASH FOREST *(Hemlock-Hardwood Swamp)* (Cabot Extremely Stony Soil Series)

Physiography: Level, low part of a gentle, basal till slope, water table at approximately 30-40cm (throughout?) growing season, pronounced pit-and-mound microtopography.
Soil: A horizon 20-25cm saturated black muck to mucky loam, Cd very fine to fine sandy loam, abundant bright reddish mottles at top of C horizon.
Vegetation: A diverse mix of deciduous and coniferous species, dominated by yellow birch, balsam fir, and red maple; associates include hemlock, white ash, and formerly American elm. The only shrub with considerable coverage is the creeper, dwarf raspberry. Herbaceous species include sedges *(Carex bromoides, C. prasina, C. intumescens, C. gracillima, C. scabrata),* foamflower, two-leaved mitrewort, rosy twisted-stalk, swamp saxifrage, tall meadow-rue, sensitive fern, lady fern, intermediate and crested wood-ferns, goldthread, mountain wood-sorrel, false hellebore and many others. The moss, *Thuidium delicatulum,* is abundant in patches.
Comments: Most similar to ecosystem types 14 and 19, type 17 is intermediate between the two in moisture. Unlike type 14, there are seepages which are the source of numerous streamlets. Type 17 seems to have a greater ratio of forb:fern coverage than type 14, and tree diameters tend to be smaller, probably an indication of greater moisture stress and a less aerated soil. Type 19, on the other hand, looks more like a classic, mossy, mixed swamp, with bare muck depressions and a water table at 20cm or above (June). Ecosystem types 14 and 17 do intermingle on the landscape, and there are pockets of the wetter type within broader areas of the less wet type. The pockets are so small as to require a very intensive effort to map them.

18. POORLY DRAINED, LEVEL, MUCKY SILT LOAM OVER SILT LOAM TO LOAM INCEPTISOL, RED MAPLE-YELLOW BIRCH SWAMP FOREST *(Red Maple-Black Ash Swamp)*

Physiography: Level, perched wetland in an ablation till matrix.
Soil: A horizon ~25cm black mucky silt loam, Cd horizon gleyed gray silt loam, common prominent orangey-red mottles @15cm in A horizon and abundant prominent reddish mottles at top of C horizon.
Vegetation: A relatively open tree canopy of red maple, yellow birch and black cherry overtops a patchy shrub layer of speckled alder and beaked hazel. The herbaceous vegetation is robust and tussocky; common species are cinnamon, New York and sensitive ferns, fowl-mannagrass, sedges *(Carex gynandra, C. disperma, C. projecta)* and Canada mayflower.
Comments: Similar to ecosystem type 15, but with a more open tree canopy and thus denser shrub and herb coverage. Also similar to ecosystem type 17, but more open, lacking the coniferous trees, and in an ablation rather than basal till matrix. Historic cattle grazing may have significantly impacted the current condition of the vegetation (and soil?). May be combined with one of those types after further analyses, but for now left separate. Physiognomy of the vegetation is certainly different.

19. VERY POORLY DRAINED, LEVEL, MUCK OVER STONY SANDY LOAM INCEPTISOL, RED MAPLE-YELLOW BIRCH-BALSAM FIR-RED SPRUCE SWAMP FOREST *(Red Maple-Black Ash Swamp)* (Peacham soil series)

Physiography: Level, lowest part of a gently sloping basal till landscape, water table at or very near surface throughout growing season, pronounced hummock-hollow microtopography.
Soil: Organic horizon 15-20cm sapric muck, Cd horizon gleyed brownish-gray fine to very fine sandy loam, abundant prominent reddish mottles at top of mineral soil.
Vegetation: Co-dominant trees are balsam fir, yellow birch, red maple and red spruce. Canopy height is relatively short compared to surrounding, better-drained ecosystems. Erect shrubs are an insignificant part of the vegetation, but creeping dwarf raspberry is very common. On the mounds, barren strawberry, big-leaf aster, lady fern, Canada mayflower, mountain wood-sorrel, three-flowered bedstraw, bluebead lily and three-seeded sedge are common. In the depressions grow sensitive fern, cinnamon fern, northern bugleweed, fowl-mannagrass, swamp saxifrage, marsh-marigold, purple fringed orchid, and many other species. Mosses common in the swamp include *Sphagnum* cf. *squarrosum,* stair-step moss *(Hylocomium splendens), Ptilium crista-castrensis, Thuidium delicatulum* and *Trichocolea tomentella.*
Comments: Ecosystem type 19 is the wettest, mossiest ecosystem in the study area, where it is very narrow and not very extensive. This swamp ecosystem type, however, often covers significantly larger areas when in a different topographic setting. On the property it sits at a divide from which flow Isham Brook to the south and an unnamed tributary of Baldwin Creek to the north.

20. VERY POORLY DRAINED, LEVEL, MUCK OVER STONY SANDY LOAM INCEPTISOL, ALDER-WILLOW SHRUB SWAMP/SEDGE MEADOW *(Alder Swamp/Sedge Meadow complex)* (Peacham soil series)

Physiography: Level depression surrounded by moderate inclines all around, water table near to above soil surface.

Soil: Organic horizon 30cm sapric muck, C horizon gleyed sand and gravel, abundant prominent mottles at top of mineral soil.
Vegetation: Differences between perimeter and center of wetland are apparent. The perimeter has an open tree canopy of gray birch, with dense cover of tall shrub willow. Herbs in perimeter shrubland include spotted joe-pye-weed, flat-topped aster, fowl-mannagrass, arrow-leaved tearthumb and sedges *(Carex gynandra, C. bromoides).* The central, lower, wetter portion maintains standing water throughout the year and is dominated by the sedge, *Carex rostrata;* common species include white boneset, spotted joe-pye-weed, wool-grass and tussock sedge. Scattered clumps of speckled alder, willow and gray birch saplings occur in the sedge-dominated portion. Many additional species of herbs common to open wetlands occur also.
Comments: Ecosystem type 20 is occasionally inundated by beaver. Currently none are present and the dam has washed out, thus the area is succeeding to shrubs and gray birch. It is curious that the depression in which this ecosystem type occurs on the site receives enough water to attract beaver and enable development of a pond, but it has been a pond within the past several decades.

## ANTHROPOGENIC TERRESTRIAL ECOSYSTEMS[3]

"Fields"

21. Maintained hayfield

22. Unmaintained old field--herbaceous

Comments: In one field, current vegetation consists of sensitive fern, water pipes, bristly aster, the sedge *Carex stipata,* and shrubs/saplings *(Populus tremuloides, Salix* cf. *humilis, Thuja occidentalis).* A drier adjacent field has ostrich fern, wrinkled goldenrod and red raspberry.

23. Unmaintained old field--alder shrub

Comments: The other non-forested wetland is alder and willow dominated and appears not to be a natural shrub swamp, but rather a post-agricultural successional one. The area may have been a wet pasture in the past, but it has not been explored fully and this is just conjecture. Among the dominant speckled alder and willow are saplings of white ash and black cherry. The herb flora consists principally of sensitive fern, intermediate wood-fern, water avens, wrinkled goldenrod and bristly aster; low shrubs red and dwarf raspberries common.

## AQUATIC ECOSYSTEMS

### FLOWING WATERS

24. Permanent, small, mid-elevation, cold, headwater, mountain stream[4]

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3 Since long-term management plans specify that existing fields remain as fields, they have been classified and mapped as separate ecosystem types, with recognition that these lands can also be classified and mapped according to the above geoecosystem classification.

4 Aquatic ecosystem names adapted from: The Aquatic Classification Workgroup, 1998. A classification of the aquatic communities of Vermont. The Nature Conservancy (Vermont chapter) and the Vermont Biodiversity Project. Waterbury, VT.

25. Intermittent, small, mid-elevation, cold, headwater mountain stream

26. Moderate-sized, cold, mountain stream

ANTHROPOGENIC AQUATIC ECOSYSTEMS

PONDS

27. Artificial pond