

December 15, 2020

Andrews Community Forest Committee  
Richmond, VT  
[richmondtownforest@gmail.com](mailto:richmondtownforest@gmail.com)

Re: Andrews Community Forest Ecological Trail Planning

Dear ACF Committee Members,

Arrowwood Environmental, LLC (Arrowwood) and Sinuosity, LLC are pleased to respond to the above-referenced Request for Proposals (RFP) issued by the Andrews Community Forest Committee, dated October 15, 2020. Included in this electronic submission is one PDF file of our proposal containing an overview of the project, a proposed scope of work, schedule, budget, project team qualifications and an experience on similar projects. This proposal was prepared by a collaboration of Arrowwood and Sinuosity, and I will be the point of contact for the proposal.

Our collaboration brings together a group of highly qualified Vermont-based professionals with extensive experience in ecological resource assessment and recreational trail design. Members of our team have a strong working knowledge of the Andrews Community Forest (ACF) through Arrowwood's involvement with developing the ACF Forest Management Plan.

We are excited at the opportunity to continue our work with the ACFC to design an ecologically informed trail network on the newly acquired town forest. This project will likely serve as a model for other Vermont towns that seek to strike a balance between ecological preservation and recreation on public forest lands.

If selected for this project, our team would apply our expertise to develop a trail network that provides recreationalists with an enjoyable experience while at the same time preserving those significant ecological features that make the ACF special. We look forward to working with you. Please do not hesitate to contact me with any questions regarding our submission.

Sincerely,



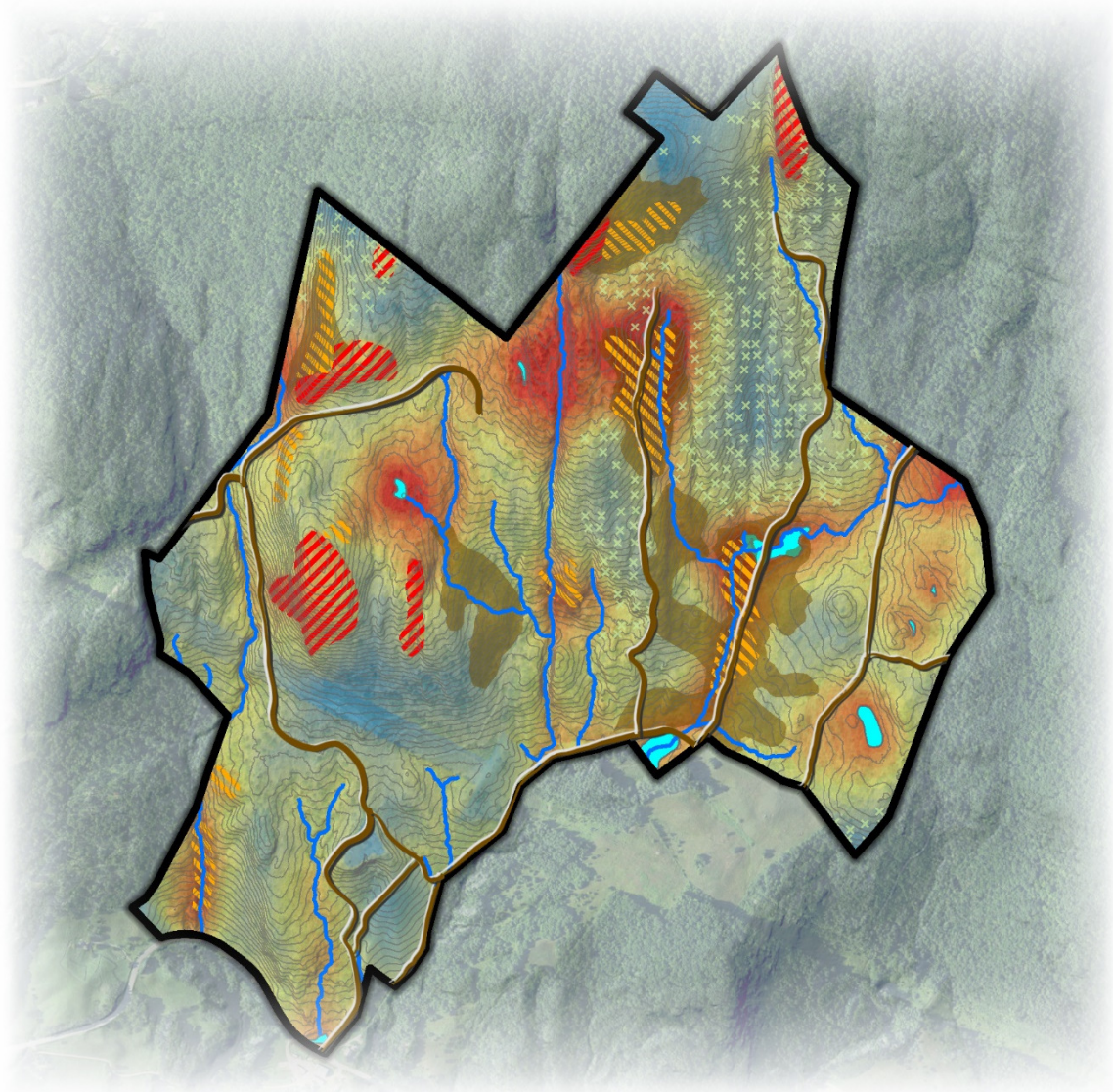
Dori Barton  
Principal Wetland Ecologist/Hydrologist

# Andrews Community Forest

Ecological Trail Planning Proposal

Richmond, Vermont

December 15, 2020



Team Contacts: Dori Barton, Arrowwood Environmental, 802-434-7276, [dori@arrowwoodvt.com](mailto:dori@arrowwoodvt.com)  
Mariah Keagy, Sinuosity LLC, 802-310-2298, [mariah@sinuosity.net](mailto:mariah@sinuosity.net)

## Section I-Project and Team Overview

### Project Understanding

Arrowwood Environmental, LLC (Arrowwood) and Sinuosity, LLC are pleased to respond to the above-referenced Request for Proposals (RFP) issued by the Andrews Community Forest Committee (ACFC) dated October 15, 2020. We believe our project team brings together a group of highly qualified Vermont-based professionals with extensive experience relating to both ecological assessments and trail design and development, ensuring the highest quality product.

Arrowwood was a member of the team that authored the Andrews Community Forest Management Plan (FMP, 2019) and through that effort conducted preliminary resource assessments of the parcel, both desktop and in-field investigation. Arrowwood collaborated with team members to develop the concept trail plan that was incorporated in the final Forest Management Plan (FMP). The concept plan and the assessment findings that were used to inform its design provide a sound foundation from which to develop and layout a finalized trail network that is sensitive to significant natural resources on the parcel.

The scope of the project, as detailed in the following proposal, includes conducting and compiling an ecological assessment of the ACF from existing resources and additional targeted field surveys (as needed). The data from the ecological assessment as well as VLT easement restrictions will be used to design a trail network that considers both the ecological sensitivities of the forest and the needs of recreationists. The project will involve the following key components:

- Ecological Assessment: Compile existing data, identify data gaps, target field investigations
- Trail Design and Flagging: Iterative process informed by ecological assessments, with ecological team members walking proposed layouts
- Public Walks
- Trail Design Approval: Presentation to ACFC, VLT and Richmond Select board
- Report and Poster

### Project Team

#### Arrowwood Environmental, LLC

Established in 2001, Arrowwood is a Vermont based consulting company comprised of three ecologists and a GIS analyst with extensive experience conducting natural resource assessments throughout the State of Vermont. The company is 25% woman owned with a preference for hiring additional women when possible for subcontracting services.

The company was founded on a shared desire to assist private and public entities in Vermont to evaluate natural resources as well as to identify and protect areas of natural significance. Scientific backgrounds in zoology, botany, ecology, surface water hydrology as well as educational experience afford us the expertise to evaluate the significance of natural resources, including wildlife habitat, wetlands, rare plants and animals, and unique natural communities, and to provide a wide range of educational services.

In addition to extensive experience conducting ecological evaluations, our qualifications also include the preparation of environmental permits and provision of expert testimony in hearing situations such as Act 250, the Water Resources Board, the Public Service Board, and local and

regional planning bodies. We have also worked with the public and various conservation organizations to help educate and help communities protect their own local natural resources.

### Sinuosity, LLC

Sinuosity, LLC is a trail development company able to provide professional services for every aspect of a trail network or project. Our mission is to plan, design, and build sustainable trails that highlight the landscape and promote enjoyable user experiences. We apply refined trail design, management, and construction techniques to minimize impact on the environment and create trail longevity.

Our specialties include design and construction of Mountain Bike Trails and Skills Parks, Multi-Use Trails, Backcountry and XC Ski Trails, Hiking Trails, and Walking Paths. Additional services include all aspects of Trail Planning, GIS Trail Mapping, Trail Maintenance Plan Development, and Trail Work Education

We were founded in 2006 by Brooke Scatchard (Trail Designer/Builder, owner), and joined by Mariah Keagy (Trail Planner/Designer, owner) in 2013, and have been members of the Professional Trail Builders Association since 2013. Brooke and Mariah's skills in trail layout and design, trail planning, construction, management, and mapping combine to make a strong team of exceptional trail skills, diverse experience, and expertise. While their skill sets are diverse and complementary, they both share a passion for creating sustainable multi-use trail networks throughout New England.

## Project Team Organization and General Approach

Our Project Team is summarized below in Table 1. Dori Barton will serve as the Project Manager for Arrowwood and Mariah Keagy will serve as Project Manager for Sinuosity. Dori and Mariah will jointly oversee each project task and ensure sound data collection and analysis, and high-quality and timely deliverables.

**Table 1. Proposed Project Team and Roles**

Company & Address	Project Team Role
<p><b>Arrowwood Environmental, LLC</b> 950 Bert White Road Huntington, VT 05462</p>	<ul style="list-style-type: none"> <li>• Ecological Assessments</li> <li>• GIS, Mapping and Spatial Analysis Services</li> <li>• Public Walks</li> <li>• Reporting, Project Poster, and Presentation</li> </ul>
<p><b>Sinuosity, LLC</b> 94 White Birch Road Morristown, VT 05661</p>	<ul style="list-style-type: none"> <li>• Trail Design and Flagging</li> <li>• Trail Construction Scoping</li> <li>• Public Walks</li> <li>• Reporting and Presentation</li> </ul>

### Proposed Project Staff

Below are brief professional biographies of Project Team personnel. Resumes are included in the Attachment.



## **Ecological Team**

### **Dori Barton, Principal Wetland Ecologist/Hydrologist, Arrowwood**

Dori Barton is a founding partner and principal wetland ecologist and hydrologist for Arrowwood. Dori has been an environmental consultant since 1997, working with public and private entities. Her responsibilities have included wetland delineations, wetland functional assessments and permitting, wetland restoration plan design, implementation, and monitoring; stream geomorphic assessments; wildlife habitat evaluations; hydrologic investigations; environmental assessments; and erosion prevention and sediment control plan design. Dori became a Certified Professional in Erosion and Sediment Control in 2003. Dori currently serves as Chair of the Huntington Select board, a board on which she has served for 11 years. Prior to that, Dori served on the Huntington Planning Commission for a period of ten years.

### **Michael Lew-Smith, Principal Wetland Ecologist/Botanist, Arrowwood**

Michael Lew-Smith is a founding partner, and principal botanist for Arrowwood. Michael has extensive experience working closely with Natural Heritage Programs, The Nature Conservancy and private individuals and organizations. He has conducted wetland delineations, ecological restorations, and natural community mapping throughout Vermont. Much of his work involves rare plant inventories for proposed development projects as well as identifying rare plant habitat. Michael works closely with state agencies to develop rare plant avoidance, minimization, and mitigation strategies for a wide variety of projects. Michael is a member of the Flora Advisory Group (FLAG), which advises the state Endangered Species Committee on rare, threatened, and endangered botanical issues in Vermont.

### **Aaron Worthley, Principal GIS Analyst/Scientist, Arrowwood**

Aaron Worthley is a partner and the principal GIS Analyst for Arrowwood, responsible for project mapping, GIS and CAD plan development, spatial data assessment, spatial database management, remote sensing, spatial, visual, and hydrological modeling, and GPS and drone surveying. Aaron also conducts field inventories and assessments for wildlife tracks, sign and habitat, avian habitat assessments and wetland delineations. Accomplishments include extensive map, plan and visual aid development for municipalities, organizations, businesses and private landowners, court exhibits, public presentations and project planning, community tree inventory project development and implementation, wildlife and bird inventories, habitat assessment, ecological predictive modeling, and mapping.

## **Trail Professionals Team**

### **Mariah Keagy, Trail Designer and Planner, Sinuosity**

Mariah Keagy began her career in trail construction and reconstruction in the Green Mountains of Vermont in 1996. She has extensive knowledge of multi-use trail design and management and diverse experience in natural resources, specializing in the New England landscape. Before returning full-time to Vermont in 2010, Mariah worked during field seasons throughout the U.S. learning about multi-use trails (hike, bike, motorized, pack and saddle, ski, and water) from the Everglades in Florida, Downeast of Maine, High Peaks of the Northeast, to the Chugach in Alaska. She returned to New England as the Trails Supervisor for the Appalachian Mountain Club, where she managed the White Mountain trails and developed a contract crew, designing and building trails throughout New England. She has a M.S. in Environmental Studies from Antioch New England and currently serves as a Vice Chair on the Vermont Trails and Greenways Council, is board member of the Green Mountain Club and 10-year member of its Trail

Management Committee. Mariah also recently completed a Wetland's Delineation course to assist in trail design and planning projects.

### **Brooke Scatchard, Trail Designer and Builder, Sinuosity**

Brooke Scatchard has been designing and building trails since 1998, completing multiple trail projects and partnering with a range of organizations. A degree in Geography from the University of Vermont enables his application of advanced knowledge and technology to trail and map projects. Brooke also worked for three years as the Director of the Fellowship of the Wheel, the largest chapter of the Vermont Mountain Bike Association. Sinuosity, LLC was founded by Brooke in 2006 and is a member of the Professional Trail Builders Association. Brooke is constantly working to build the most progressive, fun, and sustainable trails in the Northeast and is a three-time winner of the MTBVT Trail Builder of the Year people's choice award.

## Section 2- Proposed Scope of Work

Arrowwood and Sinuosity will participate in an initial meeting with ACFC to kick-off the project and verify the mutual understanding of the project context and goals. During the meeting, we will be prepared to discuss details regarding our approach and will be able to go over technical aspects of the project.

### Task 1: Ecological Assessment

There is an existing well of information about natural resources on the ACF that is a result of at least five previous assessments. These works include the desktop assessment by Arrowwood for the Four Town Science to Action Resource Inventory (2013), the Audubon Forest Bird Habitat Assessment (Hagenbuch, 2017), the Vermont Land Trust Natural Communities Map and Assessment (Diamond, 2017), the Arrowwood desktop and preliminary field assessment of the parcel for the ACF management plan (2018), and the most recent UVM Field Naturalist Program Landscape Analysis and Inventory assessment (FNP, 2019). Additional information may be available, and will be sought, from other resource professionals recently working on and familiar with the property, notably the Chittenden County Forester. Arrowwood will compile all existing natural resource data to generate a comprehensive natural resources map for the parcel. Preliminary review of this combined data set suggests that there are no significant data gaps at a macro level for the purposes of this project. There is knowledge of large wetland resources, streams, natural community types, vernal pools and potential vernal pools, ledges, deer wintering habitat, and significant mast stands. Targeted field surveys at the macro level are likely to focus on field confirmation of wildlife habitat elements and identification of wildlife movement corridors through the ACF.

Field surveys will be conducted by Arrowwood at a micro-level in the area of proposed trails as the layout evolves. We anticipate an iterative process for the trail design with initial layouts based on review and consideration of the significant natural resources identified on the comprehensive resource map and the Habitat Sensitivity Heat Map generated by the Field Naturalist Program (2019). The Project team will utilize the resource management matrices that Arrowwood developed for the Vermont Town Forest Recreation Planning Project to narrow in on areas for trail development.

Arrowwood will take the preliminary trail design and conduct an in-field review of the preliminary route to identify any significant resources that would warrant consideration and possible reroute of the trails. These resources would include but not be limited to, wetlands and vernal pools, streams, ledge habitats, significant mast producing trees, steep slopes, sensitive micro-habitats, potential wildlife travel routes, potential bat roost trees and important bird nesting features.

Data collected from the field review will be incorporated into the comprehensive natural resource map and used to inform potential changes in the preliminary trail layout. Arrowwood would conduct subsequent rounds of in-field review of any rerouted sections of trail. This process would continue until a final layout is achieved.

### Task Deliverables

- Comprehensive Resource Map (digital map and raw data)

## Task II: Trail Design and Flagging

All steps in the trail design process will be both informed and guided by ecological assessment, as described above. A variety of GIS and other digital mapping software will be used at various stages of the project to efficiently analyze areas on the property suitable to support the sustainable, durable, and cohesive character sought after for the proposed trail network.

### Conceptual Design (Assessment and field truthing)

Our process of trail design also begins with the initial meeting with ACFC and review of existing project documents to reaffirm and review trail network vision and desired goals for target trail users and trail experiences. This is usually done with an initial field visit, a review of the property and any existing trails and their conditions. We then begin to envision how the character of the landscape and any existing trail segments might complement and connect to achieve the goals of the project. Portions of this process have already been completed and are documented in the Andrews Community Forest Management Plan, which will be referenced and serve as a general guide.

The next step is the review/development of the proposed conceptual design, informed by ecological assessments, guided by the identified goals and cross referenced with spatial data on soils, slope, and landscape conditions for the area identified for the design. The result is an updated trail concept map with areas identified as most likely to support enjoyable, sustainable, and cost-effective trail building and lines representing conceptual (potential) trail zones (and/or corridors). These areas are generally characterized by well-drained soil with varying topography, minimal stream crossings, and a good base of mineral sub-soil. A portion of this process was completed as well and will be referenced whenever possible.

### Trail Corridor Identification

Once these suitable areas and larger potential corridors have been determined in concept according to both trail sustainability and ecological values, the concept is field truthed. Focused and in-depth field exploration begins to identify viable trail corridors through these larger conceptual zones. Corridors are generally determined within 100-200' initially and mapped with a GPS. In this stage of trail design, we determine a trail's level of difficulty, designed user groups, potential direction of travel (if applicable) and identification of features which may serve as "Points of Interest" (such as rock ledges, large trees, overlooks, or other locally unique features) to route the trail over or near, as well as areas to be avoided for various reasons (such as natural resource sensitivity, the continuity of the desired trail difficulty, or other management concerns).

### Trail Corridor Flagging

The final phase is refining these larger corridors into a clearly defined trail alignment and flagging marked corridor. This step includes refining the trail locations within 5-10' and marking the corridor with flagging tape on trees (and/or with pin flags in the ground.) Smaller site-specific sustainability considerations are taken into account on the microscale, such as routing trails

above trees on a slope as opposed to below (in order to reduce root exposure and damage), minimizing impacts at any water crossings by thoughtful placement, and building in and over features that provide enjoyment for as large a diversity of user groups and skill as possible as well as general variety of experience. Ecological review and any required alterations on this level will serve as one of the steps to finalizing the flag line for approval.

The last step will be to compile the scope of work for trail construction, to be included in the project Summary Report.

#### Task Deliverables

- Refined, (Ecologically Informed) Conceptual Design w/ Map
- Flagged Trail Alignment
- Scope of work for Trail Construction (included in the Summary Report)

### Task III: Public Walks

The timeframe of the Project coincides with a global pandemic resulting in Statewide restrictions on public gatherings. For the purposes of this proposal, we assume that small gatherings will be permitted for this project and that we will be able to bring either the ACFC or Richmond residents out to the land to see portions of the trail alignment and ecological considerations during the design process. The focus and structure of the walks will be coordinated with the ACFC to best suit the project timeline, goals, and interests of the community.

#### Task Deliverables

- 2 Public Walks

### Task IV: Report and Presentation

A summary report will be compiled to briefly document the process of both the ecological assessment, as well as the trail design process (as defined in Tasks I & II). Maps and trail descriptions will be included, as will the suggested scope of work for trail construction.

The Project Team will present the final trail alignment to the ACFC, Richmond Selectboard, and VLT at a joint meeting.

Arrowwood will design a project overview poster for display at kiosks on the ACF. The poster will seek to educate ACF users about the sensitive ecological resources on the property and how the trail design considers and integrates those resources in layout and usage.

At the conclusion of the project, GIS data and all pertinent photos from above tasks will be provided to the ACFC.

#### Task Deliverables

- Summary Report (comprising process and outcomes of Tasks I & 2)
- Joint Presentation to ACFC, Richmond Select board, VLT
- Poster (print-ready digital format)
- Pictures (compiled from previous tasks)
- GIS Data



## Section 3 – Project Performance Measures, Deliverables, Schedules, and Budget

Included in Table 3 is a summary of project performance measures, deliverables, and schedule proposed by our project team.

**Table 2. Performance Measures, Deliverables, Target Dates**

<b>Task</b>	<b>Performance Measure/Task</b>	<b>Deliverable</b>	<b>Timeframe</b>
1	Ecological Assessment	<ul style="list-style-type: none"> <li>• Comprehensive Resource Map</li> </ul>	February- April 2021
2	Trail Design and Flagging	<ul style="list-style-type: none"> <li>• Conceptual Trail Design</li> <li>• Corridor Flagging</li> </ul>	March- May 2021
3	Public Walks	<ul style="list-style-type: none"> <li>• 2 Public Walks</li> </ul>	April-May 2021
4	Report and Presentation	<ul style="list-style-type: none"> <li>• Summary Report</li> <li>• Poster</li> <li>• Presentation</li> <li>• Pictures</li> <li>• GIS Data</li> </ul>	May 2021

The proposed cost estimate is presented in the table below. The hourly rate for work conducted is \$65/hr.

**Table 6. Proposed Budget**

<b>Task</b>	<b>Arrowwood Hours</b>	<b>Sinuosity Hours</b>	<b>Cost</b>
<b>Task 1. Ecological Assessment</b>	<b>34</b>	<b>10</b>	<b>\$2860</b>
<b>Task 2. Trail Design and Flagging</b>	<b>20</b>	<b>51</b>	<b>\$4615</b>
<b>Task 3. Public Walks</b>	<b>8</b>	<b>8</b>	<b>\$1040</b>
<b>Task 4. Report, Poster, and Presentation</b>	<b>30</b>	<b>24</b>	<b>\$3510</b>
<b>Project Totals</b>	<b>92</b>	<b>93</b>	<b>\$12,000</b>

## Section 4-Team Qualifications and Sample Projects

Resumes of team members are included in the Attachment. Below are brief summaries of four completed projects of similar nature to the requested scope of work.

**Project #1: Northfield Town Forest Stewardship Plan (October 2019):** Arrowwood conducted a natural resource inventory of the ~400-acre Northfield Town Forest including the identification, mapping, assessment and ranking of significant wildlife habitat, wetlands, vernal pools, and upland natural communities. Arrowwood also drafted a Stewardship Plan with the Northfield Conservation Commission which included the results of the resource inventory as well as laying out strategies, activities, and management recommendations based upon the priorities of the Northfield Conservation Commission.

[http://www.northfield-vt.gov/text/Conservation/Northfield\\_Town\\_Forest\\_Stewardship\\_Plan.pdf](http://www.northfield-vt.gov/text/Conservation/Northfield_Town_Forest_Stewardship_Plan.pdf)

Reference: Northfield Conservation Commission

Ruth Ruttenberg (Northfield Town Forest Committee) [rruttenberg@tds.net](mailto:rruttenberg@tds.net)

**Project #2: Vermont Town Forest Recreation Planning Natural Toolkit (2019):** Arrowwood authored the natural resources guide pod as part of the overall Vermont Town Forest Recreation Planning Project. The document provides a reference to Vermont communities with recommendations regarding compatible uses and activities in and near various natural resources, including vernal pools, significant wildlife habitats, wetlands, streams, and significant natural communities. The natural resources guide is intended to assist towns in making informed decisions about recreational activities by providing a range of considerations in protecting, maintaining, and enhancing natural resources in town forests.

[https://vtcommunityforestry.org/sites/default/files/pictures/tf\\_natural\\_resource\\_guide\\_revised\\_9\\_23.pdf](https://vtcommunityforestry.org/sites/default/files/pictures/tf_natural_resource_guide_revised_9_23.pdf)

Reference: Katherine Forrer (Vt. Urban and Community Forestry) [Katherine.Forrer@uvm.edu](mailto:Katherine.Forrer@uvm.edu)

**Project #3: St. Albans Town Forest Comprehensive Trail Plan (2015):** The St. Albans Town Forest is a 162-acre forest located on French Hill in St. Albans Town, VT. It is in active management for a variety of human powered recreation and serves as a demonstration of active Migratory Bird Habitat Enhancement. Working in concert with the county forester (Nancy Patch) and Bird Naturalist/Expert Bridget Butler (and guided by public input), Sinuosity assessed, designed, and flagged what became a 5-mile network of trails. The first meeting to discuss connectivity though development of a regional plan begins next week, entirely due to the project's success in serving the local residents.

<https://stalbanstown.com/wp-content/uploads/2014/04/St-Albans-Town-Forest-Final-Trail-Plan.pdf>

Reference: Jessica Frost (RiseVT), [jfrost@nmcinc.org](mailto:jfrost@nmcinc.org)

**Project #4: Scrag Forest Trail Design (2014, 2020):** The Scrag Forest is a unique conserved natural area valued by the residents of the town of Waitsfield and the Mad River Area for the diversity of natural and cultural resources it provides: wildlife habitat, forest diversity, vistas of the Mad River Valley, landscape history, recreation, and timber products. Design for reroutes and new trail construction will open more of this valuable town resource to sustainable recreation and allow for opportunities to use this forest to access the rich natural history, wildlife, and sustainable forest management experiences. Original plan was in 2014, though its implementation was put on hold for acquisition of an additional parcel, which was just procured. Sinuosity has been hired again to continue this process, with the additions of the newly acquired parcel.

[http://waitsfieldvt.us/wp-content/uploads/2015/12/Waitsfield\\_Scrag\\_Forest\\_Final\\_Trail\\_Report\\_Sinuosity\\_2014.pdf](http://waitsfieldvt.us/wp-content/uploads/2015/12/Waitsfield_Scrag_Forest_Final_Trail_Report_Sinuosity_2014.pdf)

Reference: Phil Huffman, (Waitsfield Conservation Commission) [phil@madriver.com](mailto:phil@madriver.com)

For a complete portfolio of our respective Projects, please visit:

<https://sinuosity.net>, <https://arrowwoodvt.com>

# DORI BARTON

PARTNER — PROJECT MANAGER — WETLAND ECOLOGIST — HYDROLOGIST



## Areas of Expertise

- Project Management
- Environmental Permitting and Expert Testimony
- Wetland Delineation and Assessment
- Stream Geomorphic Assessments
- Wetland Restoration Design and Implementation
- Wildlife Habitat Assessments

## Education & Professional Training

- M.S., Watershed Science, Colorado State University, 1996
- B.A., Political Science and Environmental Studies, Dartmouth College, 1992
- Vt. Regulatory Review Planning for Endangered Bats (February 2017)
- Vermont Natural Shoreland Erosion Control Certification (2016, 2018, 2020)
- Vt. Stream Geomorphic Assessment Phase 2 Training (2003, 2005)
- Certified Professional in Erosion and Sediment Control; #2634 (2003)
- Erosion and Sediment Control Awareness Class (2003)
- Keeping Track Wildlife Training Course (2002-2003)
- Botany Courses (2001, 2013, 2015, 2019)
- Hydric Soils Courses (1998, 2001)
- Field Techniques for Soil Evaluation (1997)

**M**s. Barton is a project manager and principal ecologist for Arrowwood Environmental. Her responsibilities include wetland delineations, wetland functional assessments and permitting, wetland restoration plan design, implementation and monitoring; stream geomorphic assessments and bridge and culvert assessments; wildlife habitat evaluations; hydrologic investigations; and erosion prevention and sediment control plan design. Ms. Barton is frequently called upon to provide expert testimony in Act 250, Act 248 and District Court for a wide range of projects and clients. Ms. Barton provides expert project management skills ensuring high quality work products completed in an efficient and timely manner. Ms. Barton is committed to giving back to her home community and currently serves as Chair of the Huntington Selectboard, and previously served on the Huntington Planning Commission for a period of ten years.

## Significant Projects & Experience

- Wetland Reclassification: Provide technical support and detailed analysis to support Class I reclassification petition for the LaPlatte River Marsh Wetlands.
- Renewable Energy: Project manager and principal ecologist working with project sponsors and engineers of small and large scale solar and wind projects to design layouts that avoid and protect significant natural resources.
- Wetland Restoration: Conduct impact assessments, design, implement and monitor site specific restoration plans for voluntary and/or mandatory regulatory permit compliance.
- Vt. DEC RCPP Wetland Project Outreach and Development project: Project manager and principal wetland ecologist for Prioritization and development of 250 potential wetland restoration sites within the Lake Champlain Basin in Vermont.
- Utility Projects: Identify and map stream and wetland resources for Green Mountain Power line upgrades and line extensions. Coordinate wetland permitting with State and Federal agencies as needed.
- Ski Resort Development: Conduct field assessments and coordinate environmental permitting with State and Federal agencies including Vt. Wetlands Program, US ACOE, and Vt. Stream Alteration Program.
- Vt. Dept. of Environmental Conservation: Conduct fluvial geomorphic assessments and prepare River Corridor Plans.

# MICHAEL LEW-SMITH

PARTNER — ECOLOGIST — BOTANIST



## Areas of Expertise

- Rare, Threatened and Endangered Plant Inventories
- Aquatic Plant Inventories
- Wetland Delineation
- Natural Community Mapping and Assessment
- Freshwater Mussel Inventories
- Vernal Pool Mapping and Assessment
- Invasive Species Mapping and Management
- Wetland Restoration
- Rare Plant Transplantation and Monitoring

## Education & Professional Training

- M.S., University of Minnesota Department of Plant Biology, 1997
- B.S., University of Michigan School of Natural Resources. Natural Resource Management, 1991
- Freshwater Mussel Identification and Ecology, USFWS Training Center, Shepardstown, WV, 2016
- Reptiles and Amphibians of Vermont, Hogback Community College Vt. Family Forests. Bristol VT, 2011
- Boreal Flora, University of Michigan Biological Station, 1995
- Bryophytes, University of Michigan Biological Station, 1995

Mr. Lew-Smith is an ecologist and principal botanist for Arrowwood Environmental. He has worked closely with conservation organizations, agencies, municipalities, companies, and private individuals on natural resource identification, assessment and management. Mr. Lew-Smith conducts botanical inventories, wetland delineations, wildlife habitat assessments, and ecological restorations. He also has considerable experience mapping and assessing natural communities for private organizations and public land managers and is currently working on an aquatic natural community classification system. Mr. Lew-Smith regularly conducts inventories of aquatic invasive species and rare aquatic plants and works closely with lake associations on aquatic vegetation management plans. Mr. Lew-Smith has also worked throughout Lake Champlain mapping and controlling aquatic invasive species. He is one of the founders of the Vermont Vernal Pool Mapping project, which mapped and assessed vernal pools statewide.

## Significant Projects & Experience

- Aquatic Species Mapping and Assessment: Map native and non-native aquatic plants in lakes throughout Vermont and develop plans for the management of aquatic nuisance species. Monitoring potential Asian Clam infestation sites in Lake Champlain.
- Northern Pass: Project Manager and ecologist working for the NH Attorney General's office on providing an independent review of the environmental assessment of the proposed Northern Pass transmission line.
- Wetland Reclassification: Provide technical support and detailed analysis to support Class I reclassification petition for the LaPlatte River Marsh Wetlands.
- Renewable Energy: Project manager and principal ecologist working with project sponsors and engineers of small and large scale solar projects to design layouts that avoid and protect significant natural resources.
- Member of the Floral Advisory Group: Advising the Vermont Endangered Species Committee on matters related to Vermont's Rare, Threatened and Endangered Plants.
- Vernal Pool Mapping: Co-founder of the Vermont Vernal Pool Mapping Project. Developed a vernal pool mapping methodology and a statewide Vernal Pool map and database.

# AARON WORTHLEY

PARTNER — GIS ANALYST — SCIENTIST — UAS PILOT



## Areas of Expertise

- Geographic Information Systems
- UAS / Drone Mapping
- Cartography & Web Mapping Tools
- Wildlife Assessment & Monitoring
- GPS & Surveying
- Database Management
- Graphic Design & Layout

## Education & Professional Training

- B.A. Individual Design (social sciences, performing arts), University of Vermont, 1994
- FAA Licensed UAV Pilot (2016)
- Wetland Ferns (2/2013)
- Phase II- VT Stream Geomorphic Protocols, summer (2007)
- Wetland plant Identification (2007)
- SGAT & Phase 1 VT Stream Geomorphic Protocols, (2004)
- Vernal Pool Identification & Certification, (2006)
- Winter Identification of Trees and Shrubs workshop (2003)
- Keeping Track- Wildlife Tracking & Monitoring (2001-2002)
- Forest Mycology (2003)
- Vermont Spatial Data Partnership, semi-annual GIS Roundtables

Mr. Worthley is the principal GIS Analyst for Arrowwood Environmental responsible for project mapping, GIS and CAD plan development, spatial data assessment, spatial database management, remote sensing, spatial, visual and hydrological modeling, and GPS surveying. Mr. Worthley also conducts field inventories and assessments for wildlife tracks, sign and wildlife, avian habitat assessments and wetland delineations. As a certified UAV (drone) pilot, Mr. Worthley conducts aerial surveys, mapping, and photography to support Arrowwood's projects and clients. Accomplishments include extensive map, plan, database, and visual aid development for municipalities, organizations, businesses and private landowners, court exhibits, public presentation and project planning; community tree inventory project development and implementation, wildlife and bird inventories, habitat assessment, ecological predictive modeling and mapping, and development of web-based mapping and communication tools.

## Significant Projects & Experience

- Vermont Vernal Pool Mapping Project: Database and GIS manager for a statewide vernal pool mapping initiative.
- Audubon Vermont: Forest Bird Initiative. Field evaluations and forest management recommendations for enhancing forest bird habitat with participating landowners.
- Vermont Dept. Environmental Conservation RCPP Wetland Outreach: Database design, implementation and management, cartography, and geospatial modeling to identify and prioritize agricultural wetland restoration projects.
- Vermont Dept. Environmental Conservation, CCRPC: Fluvial Geomorphic Assessments & Fluvial Erosion Hazard mapping. Field assessments analysis and data development, erosion hazard mapping, software testing, technical support.
- Wildlife habitat spatial-modeling: A component of town-wide natural resource inventories to support management and planning decisions for wildlife habitat and corridor protection.
- Planning, and conducting aerial surveys: Mapping & photography using UAV (drone) technology in accordance with FAA regulations and ecological best-management practices.
- Wildlife monitoring and habitat assessments: Including- Wildlife track and sign documentation, remote camera deployment, live-trapping, baited track boards, aerial habitat surveys and grassland, forest & high-elevation avian field studies.

# Mariah Keagy, MS

94 White Birch Rd Morrystown, VT 05661 • (802) 310-2298 • mariahkvt@gmail.com

---

## PROFESSIONAL EXPERIENCE

**Trail Designer and Planner** 2013-present  
Sinuosity, LLC Morrisville, VT

**Trails Supervisor** 2006-2010  
Appalachian Mountain Club Gorham, NH

- Collaborated with federal and non-profit land managers to identify, plan and complete trail projects in New Hampshire, Maine and Massachusetts resulting in 100% program growth 2006-2009
- Developed and instructed sustainable trail design workshops and trainings throughout New England, coordinating outreach with a variety of non-profit partnerships
- Hired and provided leadership, mentoring, supervision, and training for 33 employees with a program revenue of \$750,000
- Responsible for 1/3 of content: Complete Guide to Trail Building and Maintenance, 3<sup>rd</sup> ed. published 2008

**National Park Service Crew Leader** 2005  
Rocky Mountain National Park Grand Lake, CO

- Planned and executed multi-use trail projects according to National Park Service Standards
- Provided training for volunteers, staff, and international trail managers in trail reconstruction and maintenance

**Trail Contractor** Fall 2004  
Independent Blue Hills, ME

**Trail Crew Leader/Member** 1997-2004  
Maine Conservation Corps Various Locations, ME  
Student Conservation Association McCall, Idaho  
Adirondack Mountain Club Lake Placid, NY  
Green Mountain Club Waterbury Ctr., VT

## EDUCATION

**Antioch New England University** Keene, NH  
M.S. Environmental Studies June, 2012

**Vermont College** Montpelier, VT  
B.A. in Environmental Studies May, 2005  
Focus on Natural History and Landscape of New England

## VOLUNTEER POSITIONS

- **Vice Chair**, Vermont Trails and Greenways Council
- **Board of Directors and Trail Management Committee**, Green Mountain Club

# Brooke Scatchard

---

94 White Birch Rd Morrisville, VT • (802) 233-0254 • brooke@sinuosity.net

## *Professional Experience*

2006 to present

### **Sinuosity, LLC, Founder/Owner**

Founder and owner of trail design/build company focusing on mountain bike and multi-use trail design, mountain bike skills parks, site design, trail construction, permitting/landowner relations, community trail work group organization, and GIS trail mapping. Provide sustainable trail design, management, and building techniques to minimize impact on the environment and create trail longevity.

2008 to 2010

### **Fellowship of the Wheel, Trail Director**

Responsible for trail design, trail construction management, volunteer management, trail construction, web site maintenance, community relations, trail permitting, develop trail construction guidelines, organize sponsorship/events, provide existing trail assessment for rework/maintenance, manage trail conditions assessments, manage trail crew, create GIS trail maps and database, and educate local public school programs on sustainable trail construction.

2008 to 2009

### **Local Motion, Trail Finder Trail Coordinator**

Manage collection of GPS trail data, categorize trails by usage, prepare data for online mapping, and coordinate with trail managers.

## *Education*

University of Vermont - B.A., graduated May 2015

Major: Geography

Minor: Applied Design

## *Affiliations*

Professional Trail Builders Association, Member

## *References*

Tom Stuessy

Vermont Mountain Bike Association

Executive Director

802-342-7568

[tom@vmba.org](mailto:tom@vmba.org)

Will Flender

Mad River Path Association

Executive Director

802-496-7284

[path@gmavt.net](mailto:path@gmavt.net)

Tom Jackman

Town of Stowe

Planning Director

802-253-2705

[tjackman@townofstowevermont.org](mailto:tjackman@townofstowevermont.org)