

Spectral Reflectance and Albedo of Snow-Covered Heterogeneous Landscapes in New Hampshire, USA: Comparison of Ground-based, Airborne Hyperspectral, and MODIS Satellite Data



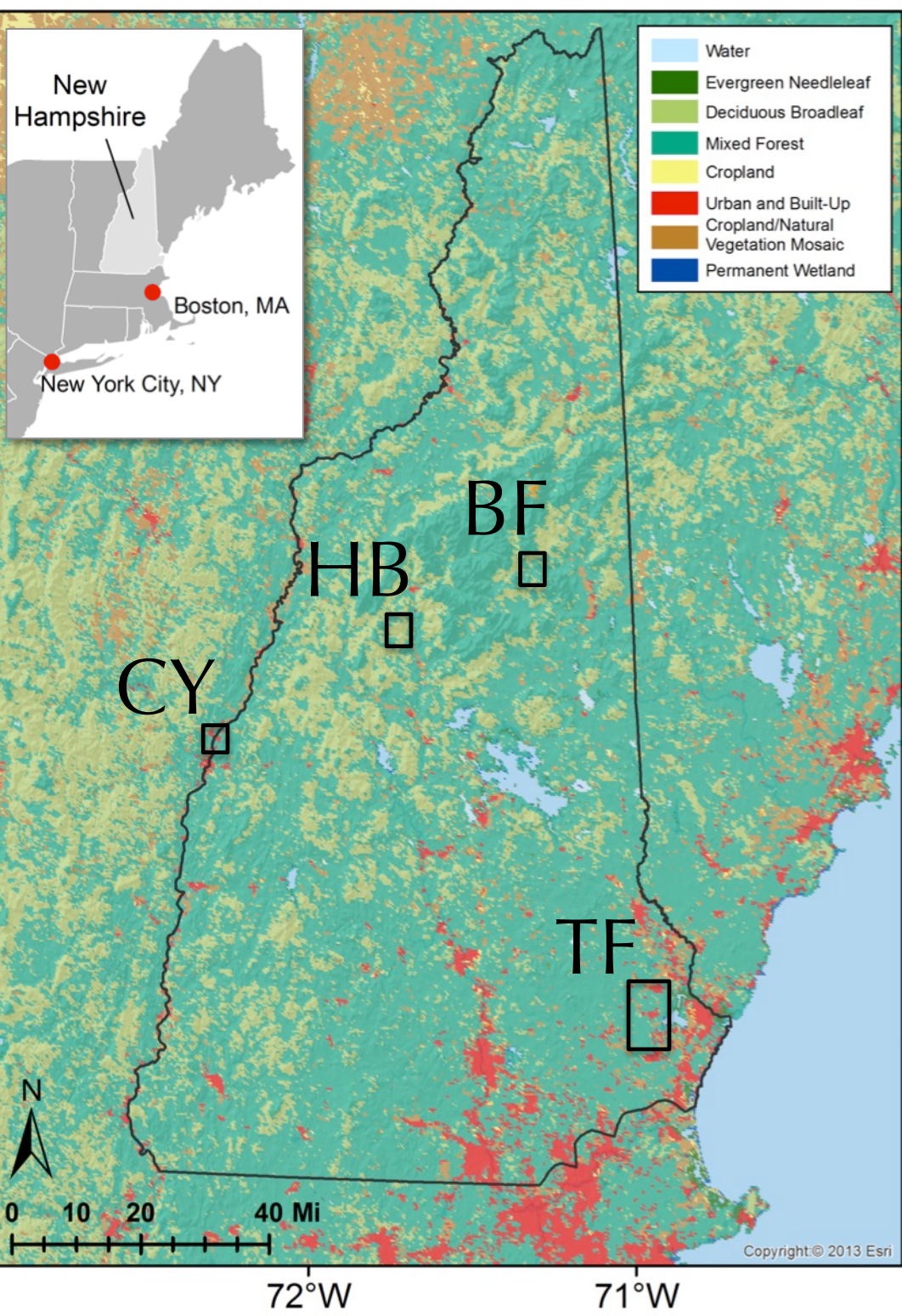
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Research Objectives

- Scaling approach to use hyperspectral imagery for MODIS validation over mixed use landscapes
- Improve snow-covered forest canopy albedo



Hyperspectral Flight



09-March-2013

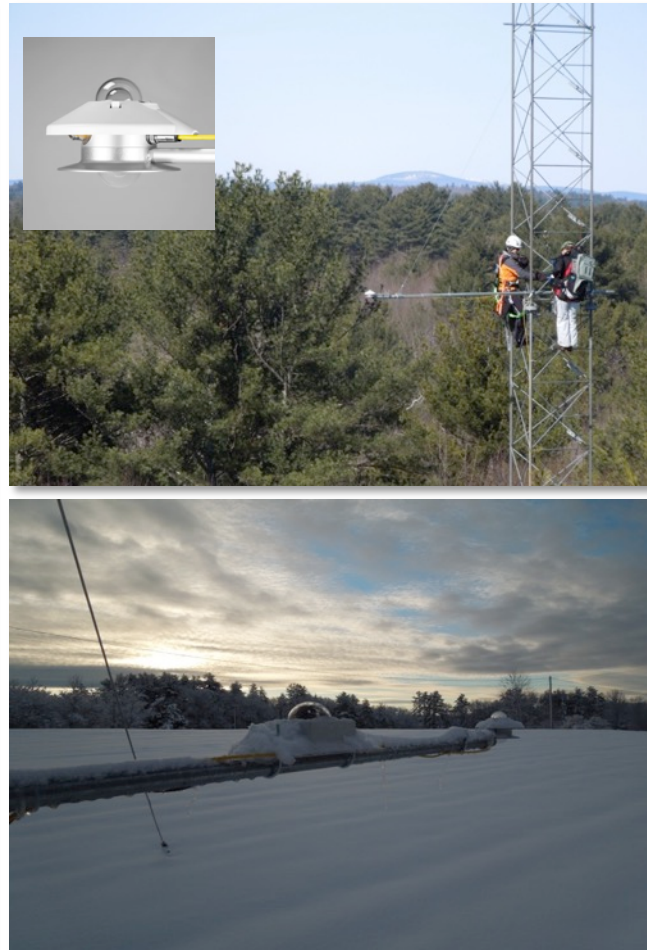
One day after snowfall event

Four study areas

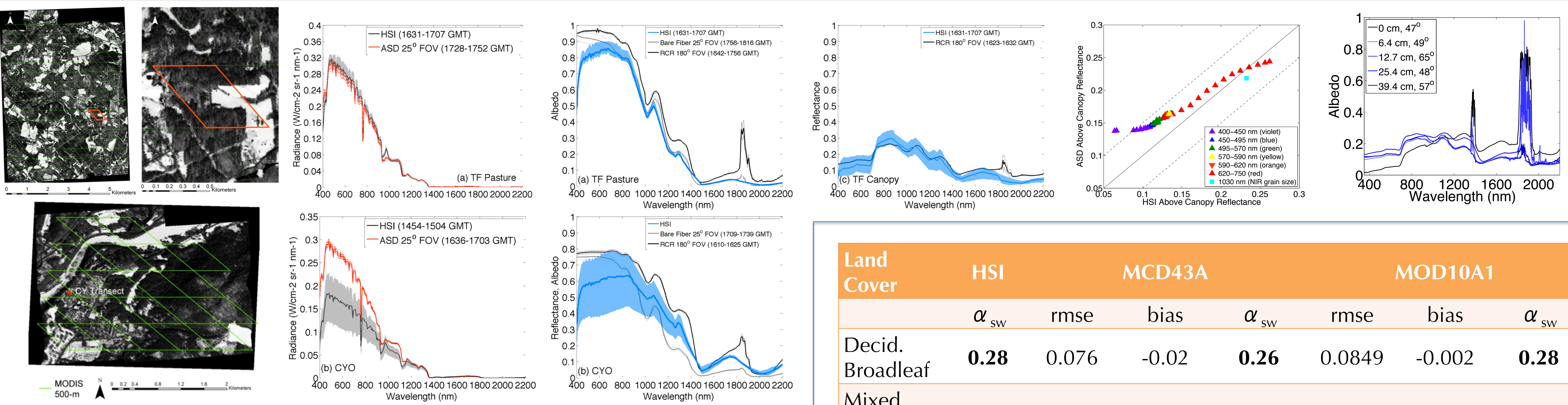
- Thompson Farm (TF)
- Cold Regions Research and Engineering Lab (CRREL Yard (CY))
- Hubbard Brook (HB)
- Bartlett Forest (BF)

Ground Validation

	Thompson Farm		CRREL Yard (CY)	Bartlett Forest (BF)	Hubbard Brook (HB)
	Pasture	Canopy			
Spectral (180° FOV)	x	x	x		
Spectral (25° FOV) with Spectralon	x	x	x		
Broadband Albedo	x	x		x	
Snow Depth and Density	x	x	x		x

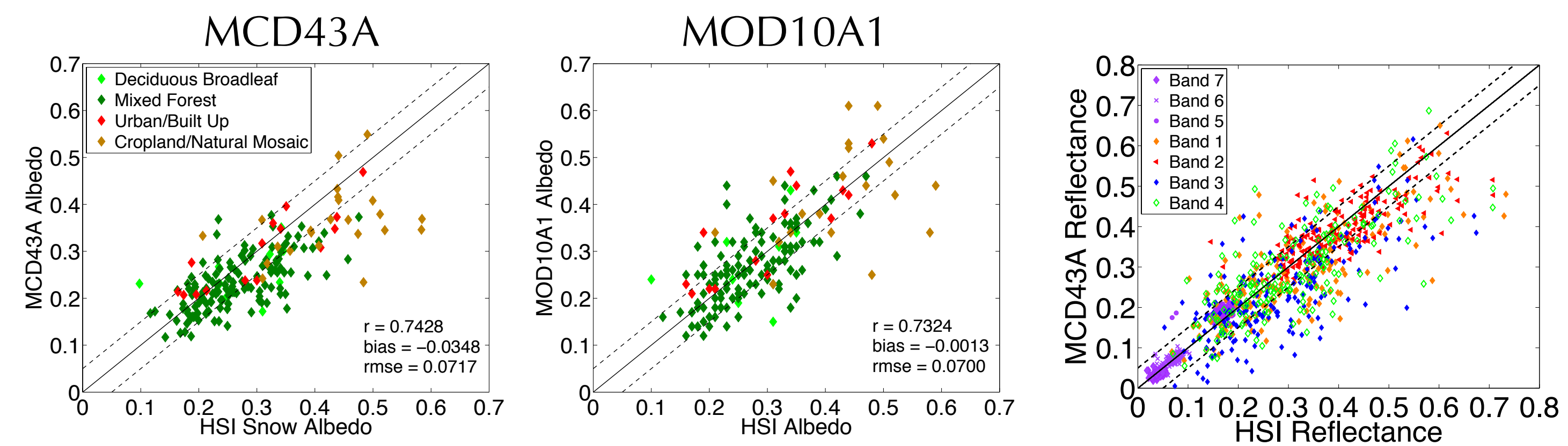


Results



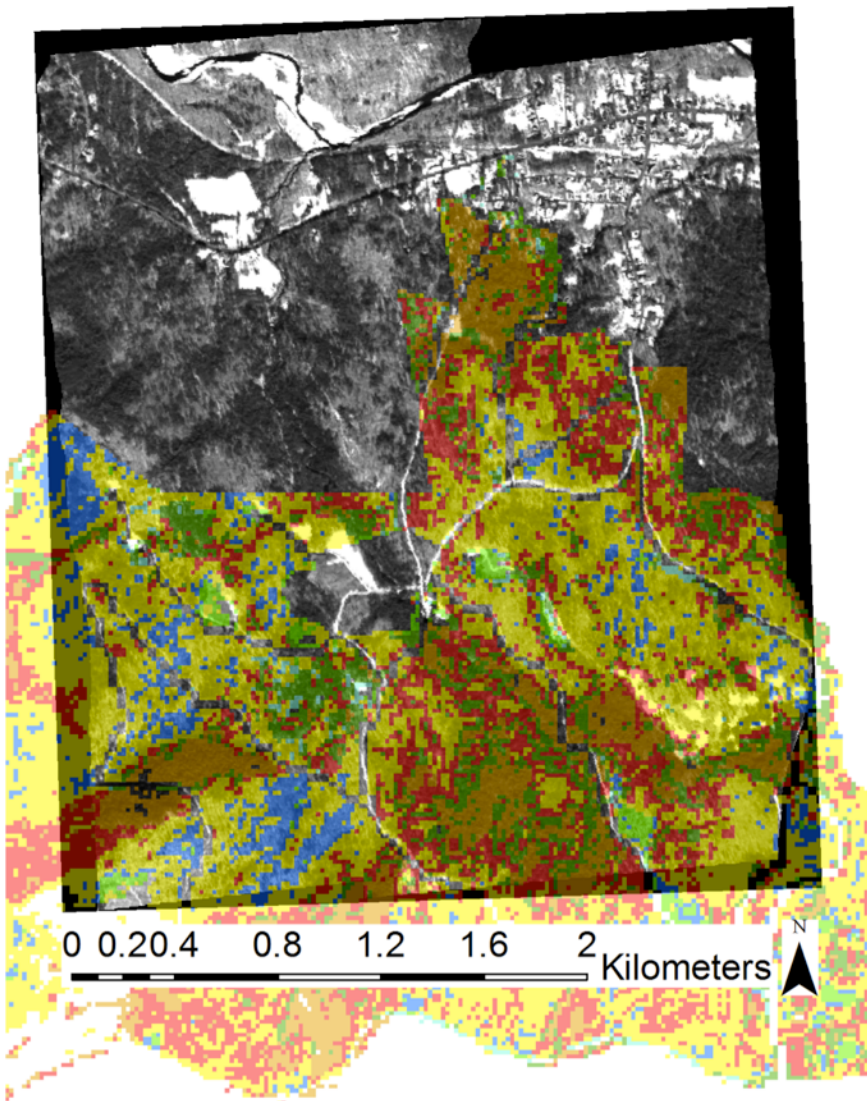
Site	Land Cover	Snow Depth (cm)	Shortwave Broadband Albedo	HSI Broadband Albedo
TF Pasture	Pasture grass	11.0	0.70	0.66
TF Canopy	Deciduous Broadleaf	25.4	0.14	0.17
Bartlett Forest Canopy	Deciduous Broadleaf	unknown	0.18	0.23

Land Cover	HSI			MCD43A			MOD10A1		
	α_{sw}	rmse	bias	α_{sw}	rmse	bias	α_{sw}	rmse	bias
Decid. Broadleaf	0.28	0.076	-0.02	0.26	0.0849	-0.002	0.28		
Mixed Forest	0.27	0.063	-0.03	0.23	0.0594	-0.006	0.27		
Crop/Nat. Mosaic	0.43	0.12	-0.07	0.36	0.1089	-0.001	0.43		
Urban & Built-Up	0.31	0.053	-0.006	0.30	0.06	0.04	0.34		



Conclusions and Future Work

- Good agreement between ground- and hyperspectral albedo over forests
- Spectral albedo does not vary with snow depth over forest canopy
- Strong attenuation of albedo at wavelengths less than 450 nm over snow-covered pasture



Species	HSI count	Mean Albedo	SEM
American Beech	7674	0.16	0.001
Eastern Hemlock	2300	0.12	0.001
Red Maple	3424	0.13	0.001
Red Spruce	2144	0.10	0.001
Sugar Maple	1428	0.16	0.002
White Pine	199	0.19	0.007
Other/Mixed	338	0.22	0.006