

Revegetation Analysis of Ski Resorts:

Leveraging Wild Fire Analysis Methods

What is the revegetation rate of ski slopes in Colorado?

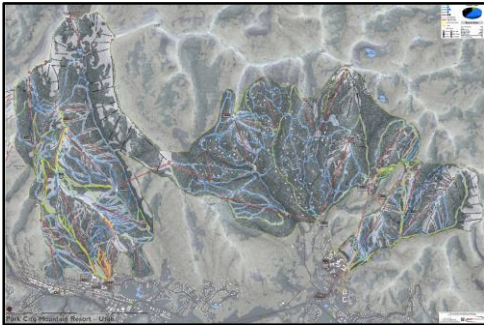
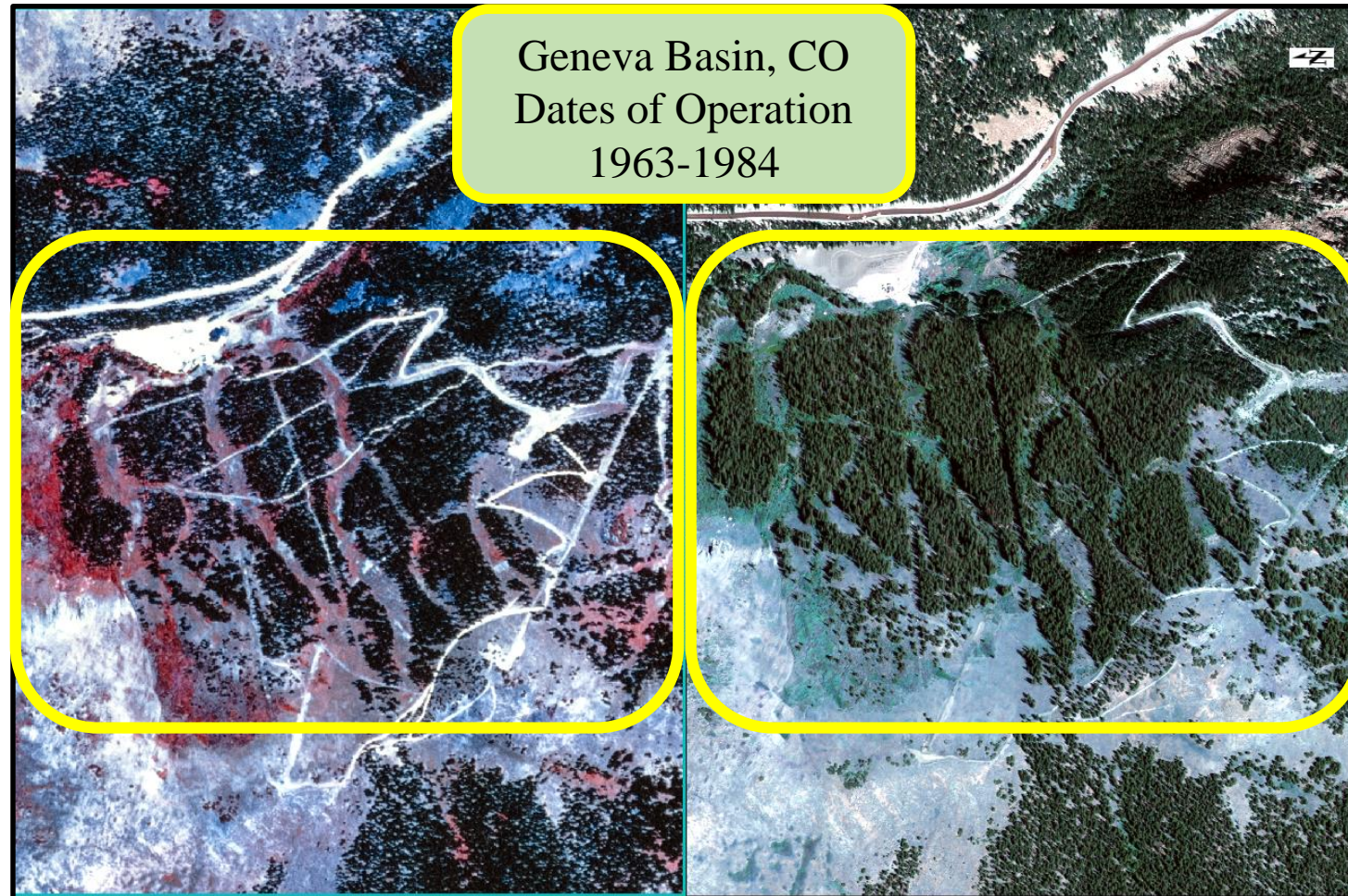


Image courtesy of [Mapsynergy](https://www.mapsynergy.com/)



Geneva Basin, CO 1988

Geneva Basin, CO 2015

Colorado Ski Resort

- 30 Active resorts
- ~145 Closed resorts
- Slope creation methods: a) clearing b) grading

Data Selection & Analysis

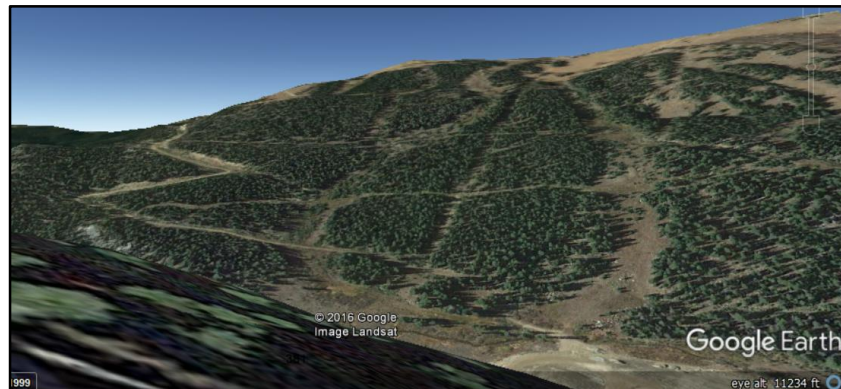
Data

Required Site Conditions

- Closed for at least ten years
- Little or no alpine ski touring traffic after closure
- Imagery available for peak years of operation
- Recent Landsat imagery
- Imagery at peak growth season
- Imagery without snow on closed slopes

Sources

- Power Ghost Towns & Lost Resorts
- Google Earth
- USGS EarthExplorer



Methodology

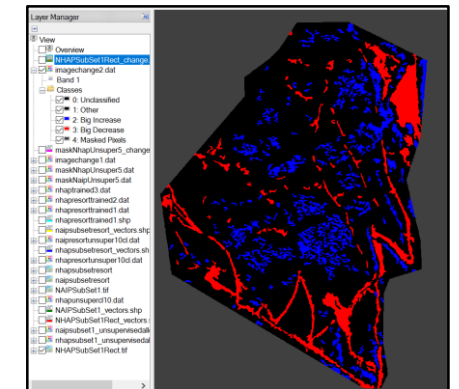
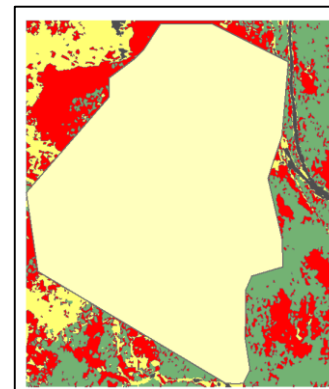
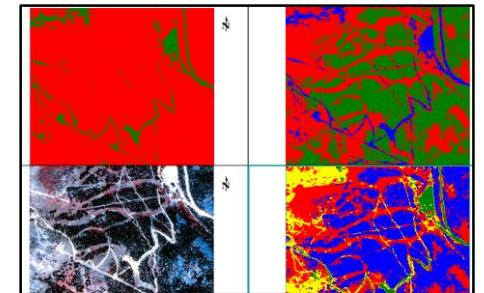
Apply established wild fire revegetation analysis techniques to calculate revegetation of closed ski resorts.

ArcGIS

- Select Spatial Subset
- Register Images

ENVI

- Classification
- Image Change

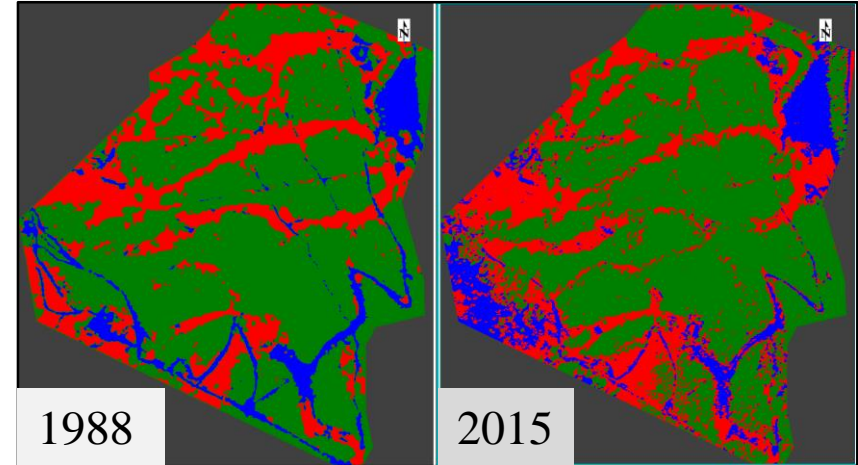


Results

Geneva Basin, CO Supervised Change Detection

Change Detection Statistics show the following revegetation rates for terrain classified as:

- SkiRuns increased in area 2.83 %.
- Glades decreased in area by 0.79%.
- DirtRoads decreased in area by 3.13%.



Change Detection Statistics (Initial State: nhpsupervised_3cl_dec5.dat, Final State: naipsupervised_3cl_dec5...

File Options Help

Pixel Count Percentage Area (Square Meters) Reference

		Initial State						
		Unclassified	SkiRuns	Glades	DirtRoad	Masked Pixels	Row Total	Class Total
Final State	Unclassified	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SkiRuns	0.000	54.420	16.337	28.730	0.086	100.000	100.000
	Glades	0.000	31.185	80.056	30.770	0.131	100.000	100.000
	DirtRoads	0.000	13.953	3.527	40.413	0.042	100.000	100.000
	Masked Pixels	0.000	0.442	0.080	0.086	99.740	100.000	100.000
	Class Total	0.000	100.000	100.000	100.000	100.000		
	Class Changes	0.000	45.580	19.944	59.587	0.260		
	Image Difference	0.000	2.833	-0.787	-3.126	0.091		

Conclusions

Conclusion: After more than two decades, analysis shows little revegetation of ski runs and roads at Geneva Basin ski resort.

Possible explanations for lack of change might be explained by the following:

- Poor training data and initial classification of terrain into the three classes resulting in either not enough distinction between features or not enough diversity of classes.
- Areas formerly considered DirtRoads transitioned to SkiRun-like environments. If one considers the ecological concept of “succession” applicable to this study, perhaps the succession occurs from DirtRoads to SkiRuns to Glades.
- Construction techniques used to create ski runs combined with the harsh environment of alpine regions in Colorado make it challenging for revegetation to occur.
- Errors introduced into the process through inaccurate georeferencing and creation of training data for supervised classification.
- Too small a sample size. One closed ski resort does not provide enough data to make wide sweeping claims about revegetation of ski resources decades after use ends.