Human Legacies of Today and a Decade Past at the Millard Learning Centre

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ES 471: Galiano Island Field Study 2024

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Introduction

In this report, I present the human legacy transect field work of students from this year's ES 471 class and compared it with that of students work in the past at the Millard Learning Centre (MLC). The synthesis of data spanning nearly a decade will inform the Galiano Conservancy Association (GCA) on the continuity or changes human legacies on the MLC property. The Millard Learning Centre is a 76-hectare site located on Galiano Island, British Columbia, which lies within the Coastal Douglas-fir ecoregion. What is now the MLC has evolved with the Indigenous peoples who have lived on the land since time immemorial and more recently with homesteaders, farmers, and other settlers starting in the 1800s. The most recent use and the one that is likely to have a long trajectory as a outdoor learning center managed by the GCA.

The human legacy transect method was developed in 2013 by Keith Erickson and Eric Higgs to supplement ecological mapping of the MLC. Apart from teaching diverse field skills, the method sampled activities and legacies at the MLC with seventeen belted transects oriented north to south across the property. Students in the UVic ES 471 (formerly 441) completed all transect in 2013, and partial transects in 2014 and 2015. Almost a decade later students in the same course revived the project and completed all seventeen transects to enable an analysis of change. The human legacy transect method is a surface-view sampling method that allows easy repetition by any able-bodied people who can navigate the MLC's foliage and landscape. The study seeks to provide participants with an understanding of the historical and contemporary human relationships with the land and ecology (Savage & Stapleton 2016).

Understanding human relationships with land in the past can inform contemporary ecological structures and contemporary land use. Contemporary restoration literature refers to this as layered landscapes; a layered landscape restoration approach acknowledges human and non-human components of a landscape and allows for social and political meanings to be incorporated into restoration methods (Savage & Stapleton 2016). A layered landscape approach is the foundation of the human legacy transect method that recognizes the intersectionality and interrelationship of people and ecological systems. Layered landscapes further the ability of restoration to be informed by the past while remaining embedded in the present by unearthing the timeline of human landscape modifications alongside ecological succession (Savage & Stapleton 2016).

Methods

Field data collection in 2024 followed the same methods set out in 2013 to retain cohesion between the data sets for comparison. Data collected in 2013-2015 was handwritten, with photos taken on a digital camera and coordinates recorded with a GPS device. In 2024 students were equipped with personal smartphones installed with ArcGIS Field Maps, ArcGIS Quick Capture, a compass, and a notebook and pen for field observations. Belted transects were 100m apart and approximately 30m in width and named in ascending numerical order from east to west. Each group traversed one transect at a time after starting the transect from the northern part, which was marked with flagging tape by the GCA.

In 2024, there were five groups of 3-5 students, consisting of the entire class. Group tasks were split into two groups, with one student tasked to maintain north-to-south bearing. The rest of the group gathered field data through ArcGIS Quick Capture on a smartphone and takes handwritten field legacy features. Students tasked with using ArcGIS Quick Capture were to stand near the feature and capture a photo, which would then be uploaded to the GCAs ArcGIS database, which could then be visualized on ArcGIS Field Maps, another smartphone application. The ease of data collection and data visualization is thanks to the GCAs GIS tech that prepared all of the background work necessary for this to function in ArcGIS. The data collected via ArcGIS Quick Capture recorded the selected transect number, class, and code observed (see Figure 1), coordinates in decimal degrees with an accuracy of 5-10m, and a photo of the feature. In 2013-2015, students collected data on vegetation and non-human legacies (see Figure 2) as well as ecotone changes (e.g., forest to wetland, meadow to forest), which was omitted for data collection in 2024; therefore, those transect classes were not compared in the final analysis.

Results

The metadata from 2024 were exported from the GCAs ArcGIS database into an Excel table for analysis. Data from 2013-2015 was provided via the GCAs newly created knowledge hub (https://galianoconservancy.ca/knowledge-hub/) and then reformatted from (.csv) to fit the Excel format (.xlsx). There were 972 data points, with 520 from 2024 and 452 from 2013-2015 (see Table 1). The human legacy data were projected onto a map of the MLC created by the GCA (see Figures 3 & 4), the 2024 data was directly uploaded via ArcGIS Quick Capture, and the 2013-2015 data was imported to ArcGIS Online via Excel (.xlsx). Trends and differences in human legacies can be observed spatially when overlaying the two separate data sets (see Figure 5).

Statistical analysis of the human legacy codes and classes displays the subtle and stark differences in human relationships with the land and ecology at the MLC (see Figures 6 & 7). The human legacy classes are better understood when analyzing the underlying rates of change displayed in the human legacy codes, which are multiple sub-categories of the four categories of classes (see Figure 1). From 2013-2015 to 2024, a 15% increase in human legacy data points was observed. The transect classes expressed as a relative abundance and compared from 2013-2015 to 2024 there is an observed -2% difference in Site Modification (MOD) and Artifact (ART) labeled as Garbage. There was an +8% difference in Land Use Activity (LUA) and a -4% difference in Infrastructure (INF) across the data set (see Figure 8).

Discussion

The observed statistical differences between 2013-2015 to 2024 can be understood through an evolving and differing relationship with the land at the MLC. The differences observed in the MOD class overtime are explained by a decrease in soil modification in 2024. The differences observed in the ART class are caused by a decline in garbage and a minor increase in survey artifacts. The rise in LUA class is observed in increased environmental restoration, forest harvesting, and non-forestry or agricultural clearings. The negative difference in the INF class is due to a decrease in bridges, fences, and roads, but an increase in hydrological infrastructure and trails balances the difference.

Over the decade between the repetition of this study, human relationships with land at the MLC have significantly been driven by an increase in ecological restoration guided by the GCA. The starkest difference observed in 2024 is the large gap in ecological restoration observed in the LUA class from only one data point in 2013 to 58 in 2024. The theme of ecological restoration can also be observed with the almost direct replacements of observed roads with trails on the property. When the GCA purchased the MLC in 2012, there were many forest harvesting access roads to serve the sawmill on the property. Most of these have undergone various restoration techniques that have reshaped the landscape. New buildings have partly replaced older ones, keeping the observed buildings equivalent and increasing hydrological infrastructure to support the newer buildings and ecological restoration.

Limitations of the human-belted transect method are directly related to human and technological error probabilities. The method relies on proper compass navigation to stay in line with the given transect. ArcGIS Quick Capture relies on the integrated GPS on a smartphone, whose accuracy is anywhere from 5-10m, which can misrepresent an observed data point near the edge of the transect. In 2013-2015, the GPS devices utilized produced points with a margin of error of 1-2m, far more precise than the smartphones in 2024. The method also relies on the individual's ability to correctly and accurately identify any parameters for a human legacy with the potential for human error based on subjectivity. While cleaning the data before analysis, approximately a hundred data points were removed as they were outside the boundaries of the transects by a distance greater than eight meters in 2024. Given the data cleaned in 2024, the points were observed to follow the transects more accurately than in 2013-2015 (see Figure 5).

Conclusion

The human legacy project provides an overview of the prominent and subtle changes to human land use with the land at the MLC. The human legacy transect method is designed to be easy to conduct, repeat, and be improved upon in the hopes that future students and members of the GCA can continue to undertake this study and understand the layered landscapes of the MLC. Through the foundation of layered landscapes that present the complex interrelationships with land, the GCA can utilize the data presented to influence restoration goals. The documentation of human features over time within a landscape provided a lens into the past, present, and future connections and relationships with said landscape. The project and the data presented in this report will forever tell a story of human land use on the landscape of the MLC, and the GCA can further inform and adapt their actions with this historical database.

Acknowledgements

I would like to acknowledge the great work and foundation provided by the GCA and students before me to make this project possible. Thank you for the backend work and guidance from the GCAs GIS tech as well as legitimate guidance from the orienteering master that is Keith Erickson. Thank you to Eric Higgs and Adam Huggins the instructors of this summer’s session of ES 471 for their continued help and inspiration that drove this project to be repeated.

References

Kemp, J. 2014. Human Legacy Transect Geodatabase. Galiano Conservancy Association. https://galianoconservancy.ca/wp-content/uploads/2022/09/ES441_Kemp_Final-Design-ProjectESH.pdf

Savage, A. Stapleton, A. 2016. Human Legacies in Layered Landscapes: An Approach to Understanding Changing Land Uses. Galiano Conservancy Association. (unpublished manuscript)

Appendix A: Human legacy classes and codes

Figure 1

Human legacy transects codes 2024

PRIMARY CODE & DESCRIPTION		EXAMPLES
LUA (Land Use Activity)		
LUA-AGR	Agricultural activities	Agricultural meadow
		Garden
		Agricultural (other)
LUA-FOR	Forest harvesting	Clearcut stump area (start)
		Clearcut stump area (end)
		Stump or stump cluster
		Logs / coarse woody debris (>7.5cmø)
		Slash pile
		Processed wood
		Firewood
		Fire/burning evidence
		Forest harvesting (other)
LUA-ENV	Environmental restoration	Restoration planting
		Restoration (other)
LUA-CLR	Clearing (not FOR or AGR)	Clearing (not forestry or agriculture)
MOD (Site Modification)		
MOD-PIT	Pit/hole	Percolation test pit
		Pit (other)
MOD-SOL	Soil modification	Fill
		Compaction
		Erosion
		Soil modification (other)
ART (Artifact)		
ART-GRB	Garbage/disposals/debris	Garbage/disposals/debris
ART-SRV	Survey artifacts	Survey stake/pin
		Survey flagging
		Survey (other)
ART-ACT	Activity	Geocache

PRIMARY CODE & DESCRIPTION		EXAMPLES
INF (Infrastructure)		
INF-BLD	Building	Education facility
		Hut or cabin
		Shed or lean-to
		Animal coop
		Outhouse
		Building (other)
INF-BRG	Bridge	Vehicle bridge
		Pedestrian bridge
INF-RD	Road (≥ 2m)	Road intersection
		Parking area
		Road ditch
		Paved road
		Gravel road
		Dirt road (rough access)
		Skid Road
		Old skid road (overgrown)
		Road (other)
INF-TRL	Trail (< 2m)	Trail intersection
		Human foot trail (dirt)
		Trail stairs
		Trail marker
		Trail educational point
		Wildlife trail
		Trail (other)
INF-HYD	Hydrology infrastructure	Dug well
		Culvert
		Irrigation Ditch
		Semi-buried pipe
		Hydrology infrastructure (other)
INF-FEN	Fence	Wire fence
		Wooden fence
		Fence (other)
		Rock wall
		Gate
		Fence intersection
INF-REC	Recreational Amenities	Fire pit
		Camping pad
		Firewood storage
		Shooting range
		Recreational (other)

Figure 2

Human legacy transects codes from 2013 (Kemp 2014)

PRIMARY CODE	& DESCRIPTION	SECONDARY CODE	& DESCRIPTION	*SHAPE
TBD (To Be Determined)				
TBD	To Be Determined	TBD	To Be Determined	•
NHL (Non-Human Legacy)				
NHL-TRN	Transect Point	TRN-SOT	Start of Transect	•
		TRN-EOT	End of Transect	•
NHL-BIO	Biotic effects	BIO-DOM	Domestic grazing/browsing	•
		BIO-WLF	Wildlife grazing/browsing	•
		BIO-BVR	Beaver activity	•
		BIO-OTH	Biotic effects (other)	•
NHL-WFR	Wildfire	WFR-WFR	Wildfire evidence	•
NHL-GEO	Geological feature	GEO-BLF	Natural bluff	•
		GEO-H2O	Open water, stream, spring	•
		GEO-OTH	Geological feature (other)	•
NHL-OTH	Other Non-Human-Legacy	NHL-OTH	Other Non-Human-Legacy	•
VEG (Vegetation)				
VEG-EXO	Exotic species	EXO-INV	Invasive species	•
		EXO-HOR	Horticultural species	•
		EXO-AGR	Agricultural species	•
VEG-NAT	Native species	NAT-SIG	Native species (significant)	•
		NAT-DMG	Native species damaged	•
		NAT-CMT	Culturally modified tree	•
LUA (Land Use Activity)				
LUA-AGR	Agricultural activities	AGR-MDW	Agricultural meadow	•
		AGR-GDN	Garden	•
		AGR-OTH	Agricultural (other)	•
LUA-FOR	Forest harvesting	FOR-CLS	Clearcut stump area (start)	O
		FOR-CLE	Clearcut stump area (end)	O
		FOR-STP	Stump or stump cluster	•
		FOR-CWD	Logs / coarse woody debris (>7.5cmø)	•
		FOR-SLS	Slash pile	•
		FOR-PWD	Processed wood	•
		FOR-FWD	Firewood	•
		FOR-FIR	Fire/burning evidence	•
		FOR-OTH	Forest harvesting (other)	•
LUA-ENV	Environmental restoration	ENV-PLT	Restoration planting	•
		ENV-OTH	Restoration (other)	•
LUA-CLR	Clearing (not FOR or AGR)	CLR-OTH	Clearing (not forestry or agriculture)	•
MOD (Site Modification)				
MOD-PIT	Pit/hole	PIT-PER	Percolation test pit	•
		PIT-OTH	Pit (other)	•
MOD-SOL	Soil modification	SOL-FIL	Fill	•
		SOL-COM	Compaction	•
		SOL-ERO	Erosion	•
		SOL-OTH	Soil modification (other)	•
ART (Artifact)				
ART-GRB	Garbage/disposals/debris	GRB-GRB	Garbage/disposals/debris	•
ART-SRV	Survey artifacts	SRV-STK	Survey stake/pin	•
		SRV-FLG	Survey flagging	•
		SRV-OTH	Survey (other)	•
INF (Infrastructure)				
INF-BLD	Building	BLD-EDU	Education facility	•
		BLD-HUT	Hut or cabin	•
		BLD-SHD	Shed or lean-to	•
		BLD-COP	Animal coop	•
		BLD-OUT	Outhouse	•
		BLD-OTH	Building (other)	•
INF-BRG	Bridge	BRG-VEH	Vehicle bridge	•
		VRG-PED	Pedestrian bridge	•
INF-RD	Road (≥ 2m)	RD-RDX	Road intersection	•
		RD-PRK	Parking area	•
		RD-DIT	Road ditch	•
		RD-PAV	Paved road	ʃ
		RD-GVL	Gravel road	ʃ
		RD-DRT	Dirt road (rough access)	ʃ
		RD-SKD	Skid Road	ʃ
		RD-OLD	Old skid road (overgrown)	ʃ
		RD-OTH	Road (other)	•
INF-TRL	Trail (< 2m)	TRL-TRX	Trail intersection	•
		TRL-HUM	Human foot trail (dirt)	ʃ
		TRL-STR	Trail stairs	•
		TRL-MRK	Trail marker	•
		TRL-EDU	Trail educational point	•
		TRL-WLD	Wildlife trail	ʃ
		TRL-OTH	Trail (other)	•
INF-HYD	Hydrology infrastructure	HYD-WEL	Dug well	•
		HYD-CLV	Culvert	•
		HYD-DIT	Irrigation Ditch	ʃ
		HYD-PIP	Semi-buried pipe	ʃ
		HYD-OTH	Hydrology infrastructure (other)	•
INF-FEN	Fence	FEN-WIR	Wire fence	ʃ
		FEN-WOD	Wooden fence	ʃ
		FEN-OTH	Fence (other)	ʃ
		FEN-RCK	Rock wall	ʃ
		FEN-GAT	Gate	•
		FEN-FNX	Fence intersection	•
INF-REC	Recreational Amenities	REC-FPT	Fire pit	•
		REC-PAD	Camping pad	•
		REC-FST	Firewood storage	•
		REC-SHT	Shooting range	•

*SHAPE SYMBOLS: ● = point feature, ʃ = linear feature, O = polygon feature

Appendix B: Human legacy results expressed in ArcGIS

Figure 3

Map of human legacy data from 2024

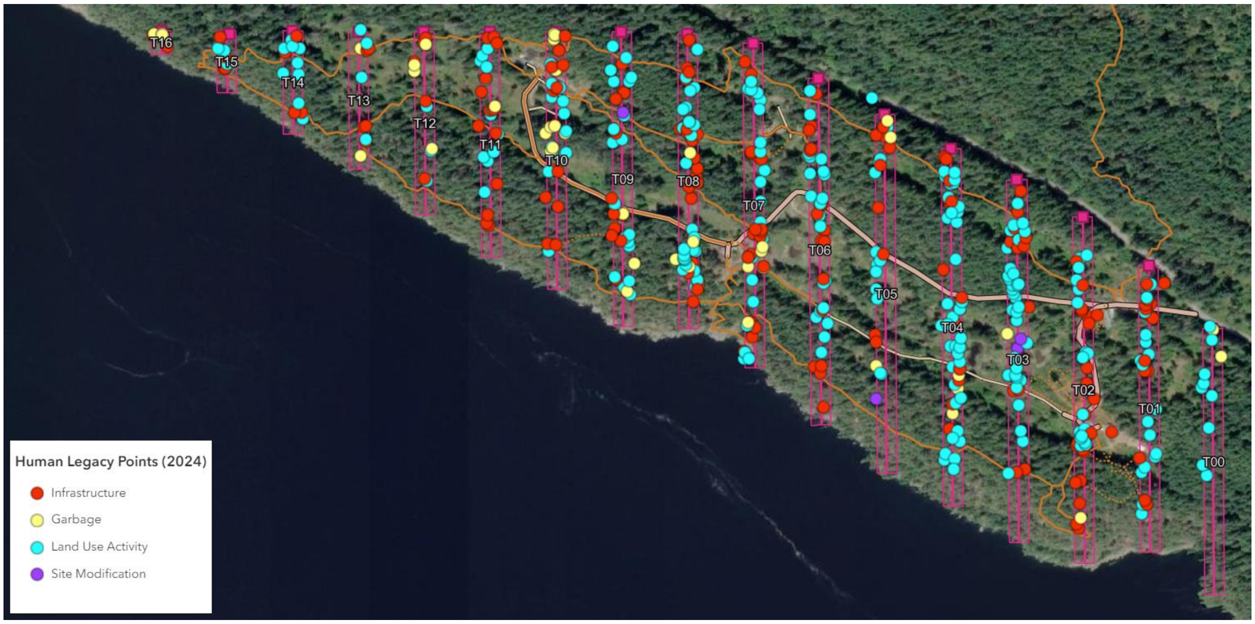


Figure 4

Map of human legacy data from 2013-2015

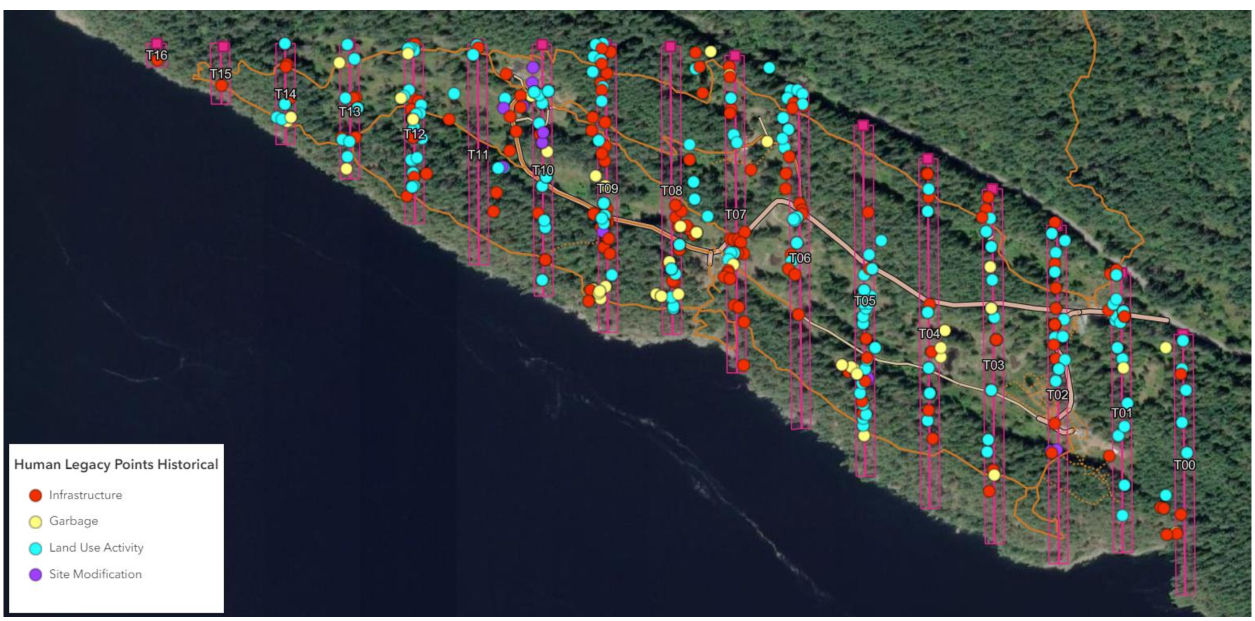
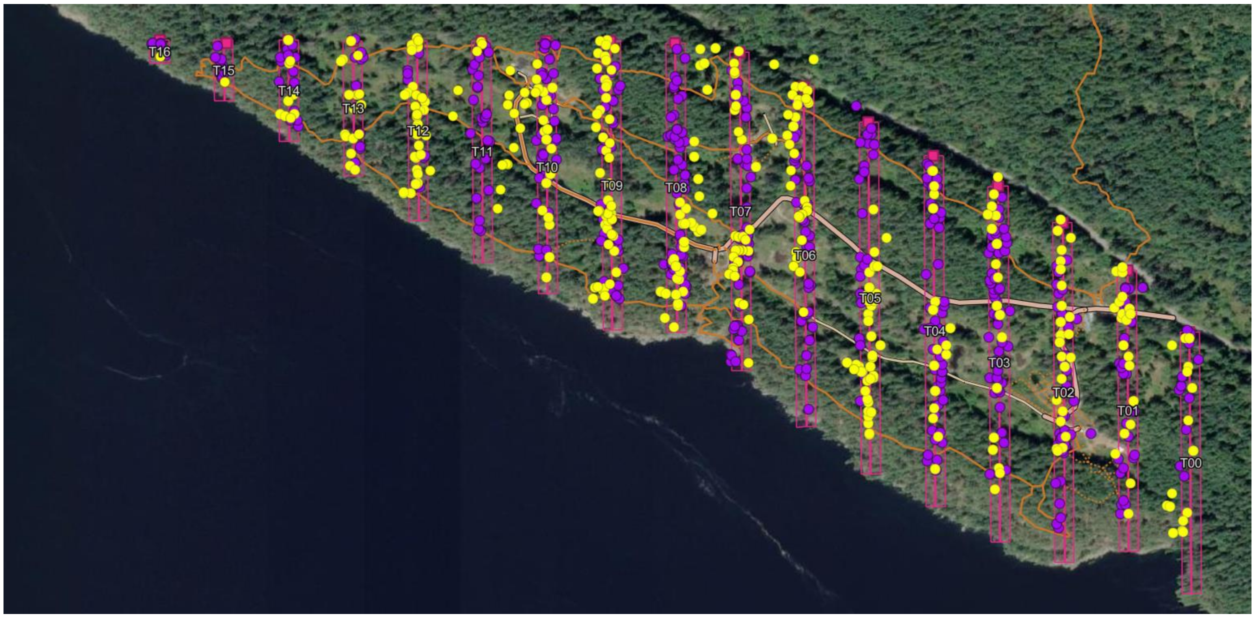


Figure 5

Map of a comparison of human legacies data from 2024 (purple) and 2013-2015 (yellow)



Appendix C: Human legacy results expressed as graphs

Figure 6

Graph comparing the human legacy classes of 2013-2015 to 2024

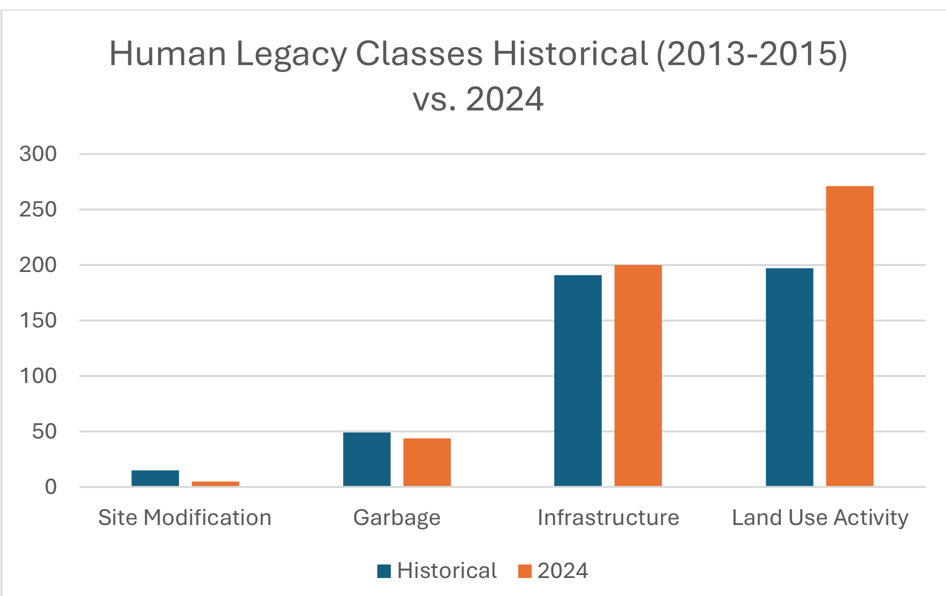


Figure 7

Graph comparing the human legacy codes of 2013-2015 to 2024

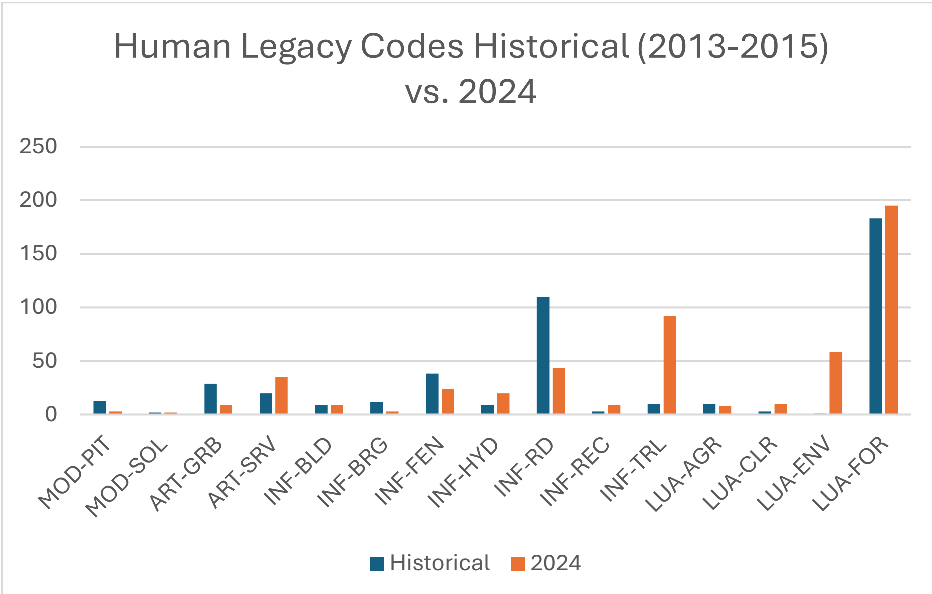
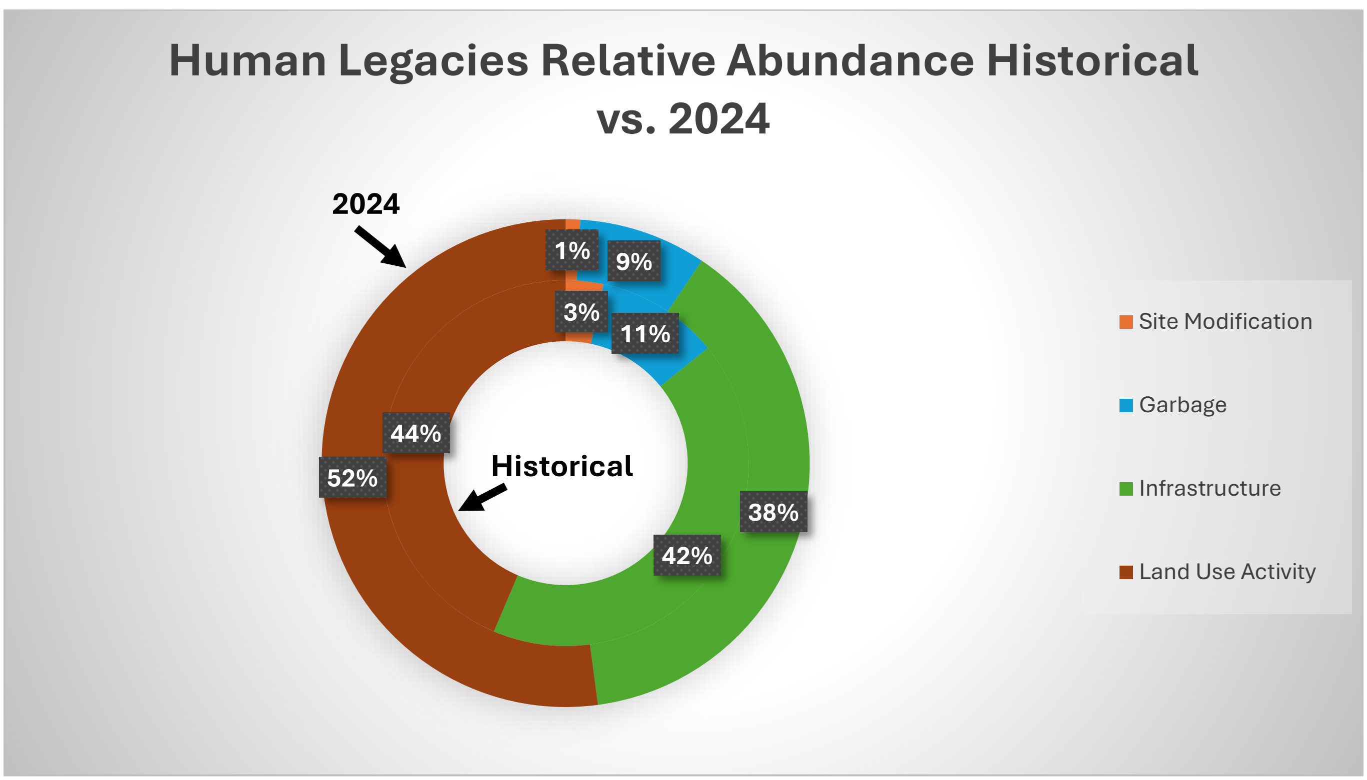


Figure 8

Donut graph comparing the relative abundance of human legacies from 2013-2015 to 2024



Appendix D: Human legacy metadata

Aggregated metadata formatted into a pivot table that provided ease of analysis and data visualization. All datapoints can be sorted by transect class, code and number. (HLP_2024_and_Historical.xlsx)

Table 1

Metadata of human legacies aggregated into a table

Count of code	**Column Labels**			
Row Labels	**2013**	**2015**	**2024**	**Grand Total**
MOD-PIT	10	3	3	16
MOD-SOL		2	2	4
ART-GRB	20	9	9	38
ART-SRV	18	2	35	55
INF-BLD		9	9	18
INF-BRG	11	1	3	15
INF-FEN	27	11	24	62
INF-HYD	2	7	20	29
INF-RD	81	29	43	153
INF-REC	2	1	9	12
INF-TRL	4	6	92	102
LUA-AGR	7	3	8	18
LUA-CLR	3		10	13
LUA-ENV	1		58	59
LUA-FOR	168	15	195	378
Grand Total	**354**	**98**	**520**	**972**