



ICIMOD

**DAY 4**  
**Exercise 4**  
**Forest Carbon Model**  
**Building Using SAR**

Sajana Maharjan

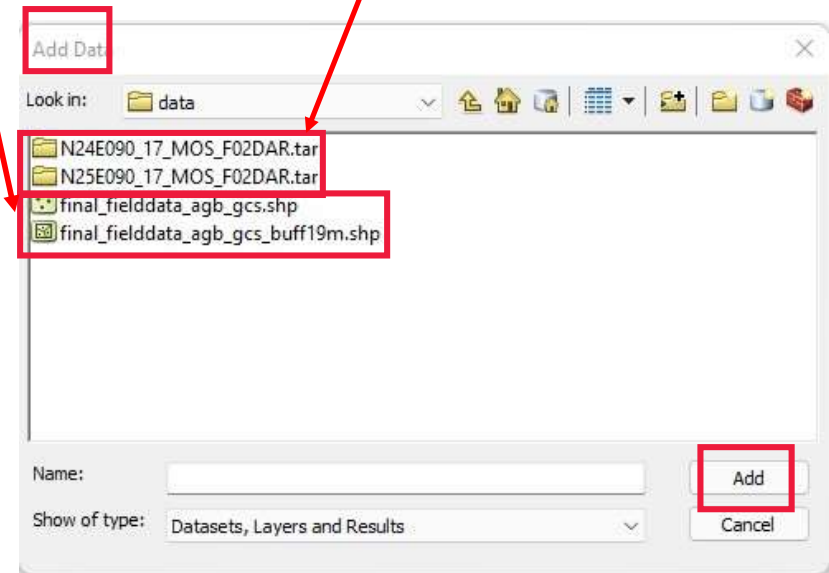
March 2022

# Forest Carbon Model Building Using SAR

- Add ALOS PALSAR mosaic images in ArcMap from **exercise\Day4\data**
- To add ALOS PALSAR mosaic images, go to its folder and drag the respective file in arcMap instead of adding them through **Add Data** in arcMap
- Add layers in ArcMap from **exercise\Day4\data**

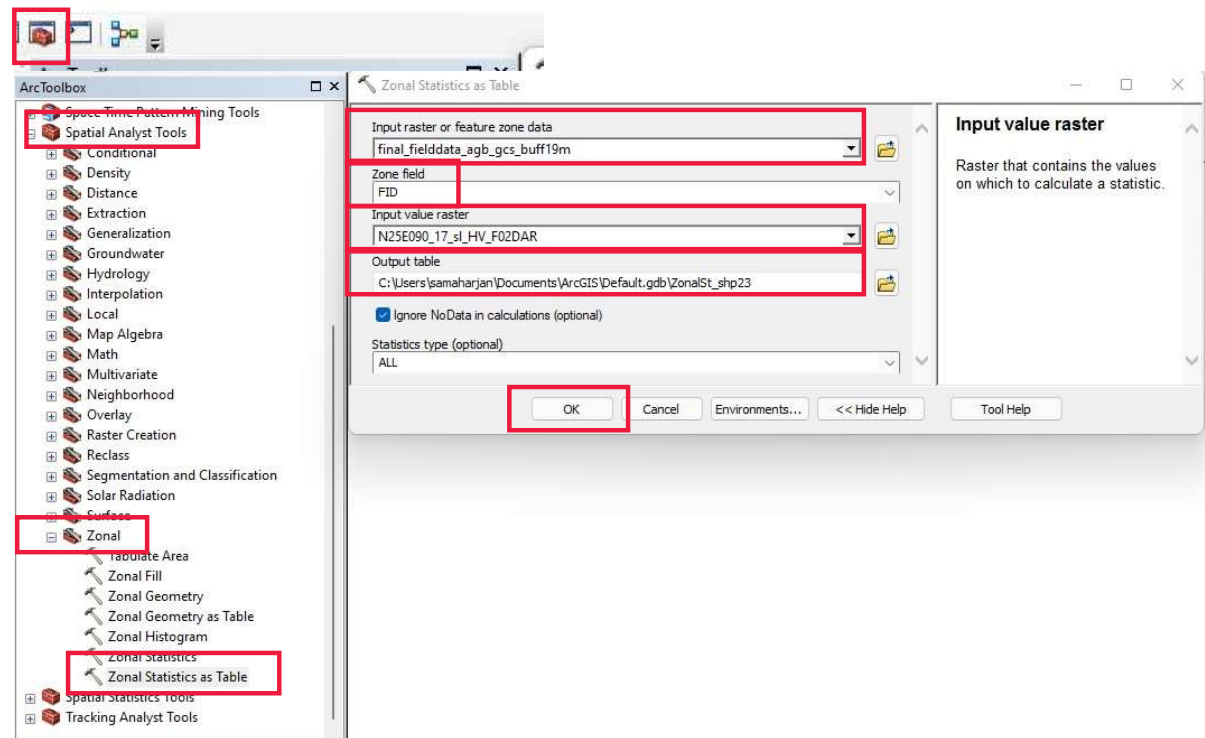
Drag these files to ArcMap

Name	Date modified	Type	Size
N24E090_17_date_F02DAR	12/8/2017 2:27 PM	File	39,551 KB
N24E090_17_date_F02DAR.hdr	12/8/2017 2:27 PM	HDR File	1 KB
N24E090_17_linci_F02DAR	12/8/2017 2:27 PM	File	19,776 KB
N24E090_17_linci_F02DAR.hdr	12/8/2017 2:27 PM	HDR File	1 KB
N24E090_17_mask_F02DAR	12/8/2017 2:27 PM	File	19,776 KB
N24E090_17_mask_F02DAR.hdr	12/8/2017 2:27 PM	HDR File	1 KB
N24E090_17_sl_HH_F02DAR	12/8/2017 2:26 PM	File	39,551 KB
N24E090_17_sl_HH_F02DAR.hdr	12/8/2017 2:26 PM	HDR File	1 KB
N24E090_17_sl_HV_F02DAR	12/8/2017 2:26 PM	File	39,551 KB
N24E090_17_sl_HV_F02DAR.aux.xml	3/21/2022 10:17 PM	XML Document	1 KB
N24E090_17_sl_HV_F02DAR.hdr	12/8/2017 2:26 PM	HDR File	1 KB
N24E090_17_sl_HV_F02DAR.ovr	3/21/2022 10:17 PM	OVR File	11,348 KB



# Forest Carbon Model Building Using SAR

- To extract raster values using buffered field plots, go to Arc Toolbox > Spatial Analyst Tools > Zonal > Zonal Statistics as Table
- Give input data, select zone field (FID) and input raster, and give output table name.



# Forest Carbon Model Building Using SAR

- The output table will have these information.
- Copy these data to excel sheet.
- Extract the raster values from the scene N24EO90 using the same shapefile.
- The output table will have these information.
- Copy these data to excel sheet.

OBJECTID*	FID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN
1	2	3	0	2541	3670	1029	3242.666667	437.800917	9728	3	2541	2541	2417
2	3	3	0	1603	2588	985	2240.666667	451.488493	6722	3	1603	1603	2531
3	4	3	0	2424	3442	1018	3102.333333	479.654274	9307	3	2424	2424	3441
4	5	3	0	3083	3780	697	3328.666667	319.558376	9996	3	3083	3083	3123
5	6	2	0	2853	5292	2439	4072.5	1219.5	8145	2	2853	2853	2853

Zonal Statistics as Table

Input raster or feature zone data: final\_fielddata\_agb\_gcs\_buff19m

Zone field: FID

Input value raster: N24EO90\_17\_sl\_HV\_F02DAR

Output table: C:\Users\samaharjan\Documents\ArcGIS\Default.gdb\ZonalSt\_shp26

Ignore NoData in calculations (optional)

Statistics type (optional): ALL

Buttons: OK, Cancel, Environments..., << Hide Help

OBJECTID*	FID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN
1	0	3	0	1418	2461	1043	2111.666667	490.500651	6335	3	1418	1418	2456
2	1	3	0	493	1932	1439	1098.333333	609.252183	3295	3	493	493	870
3	7	3	0	1934	5130	3196	3376	1323.281779	10128	3	1934	1934	3064
4	16	3	0	1304	4988	3684	2639.666667	1665.749948	7919	3	1304	1304	1627
5	17	2	0	1366	1664	298	1515	149	3030	2	1366	1366	1376

# Forest Carbon Model Building Using SAR

- If we look at the first table FID column, FID 0,1,7,16,17 are missing.
- These FID are in second table. We need to compile all these into one.
- Insert rows in first table to make FID in continuous order.
- Copy the data from second table and paste in the resp.rows of the first table

FID	OBJECTID	FID	COUNT	AREA	MIN	MAX
2	1	0	3	0	1418	2456
3	2	1	3	0	493	870
4	3	7	3	0	1934	3417
5	4	16	3	0	1304	1627
6	5	17	2	0	1366	1366
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
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18						
19						
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25						
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32						
33						
34						
35						
36						
37						
38						

CTID	FID	COUNT
1	2	
2	3	
3	4	
4	5	
5	6	
6	8	
7	9	
8	10	
9	11	
10	12	
11	13	
12	14	
13	15	
14	18	
15	19	
16	20	
17	21	
18	22	
19	23	
20	24	
21	25	
22	26	
23	27	
24	28	
25	29	
26	30	
27	31	
28	32	
29	33	

OBJECTID	FID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN
1	0	3	0	1418	2461	1043	2111.667	490.5007	6335	3	1418	1418	2456
2	1	3	0	493	1932	1439	1098.333	609.2522	3295	3	493	493	870
3	2	3	0	2641	3670	1029	3242.667	437.8008	9728	3	2641	2641	3417
4	3	3	0	1603	2588	985	2240.667	451.4985	6722	3	1603	1603	2531
5	4	3	0	2424	3442	1018	3102.333	479.6543	9307	3	2424	2424	3441
6	5	3	0	3083	3780	697	3328.667	319.5584	9986	3	3083	3083	3123
7	6	2	0	2853	5292	2439	4072.5	1219.5	8145	2	2853	2853	2853
8	7	3	0	1934	5130	3196	3376	1323.282	10128	3	1934	1934	3064
9	8	3	0	2419	4366	1947	3534	819.6621	10602	3	2419	2419	3817
10	9	2	0	571	1077	506	824	253	1648	2	571	571	571
11	10	2	0	2345	5286	2941	3815.5	1470.5	7631	2	2345	2345	2345
12	11	3	0	2591	2940	349	2758	142.8729	8274	3	2591	2591	2743
13	12	2	0	590	672	82	631	41	1262	2	590	590	590
14	13	2	0	2505	3109	604	2807	302	5614	2	2505	2505	2505
15	14	2	0	957	1012	55	984.5	27.5	1969	2	957	957	957
16	15	2	0	2506	2580	74	2543	37	5086	2	2506	2506	2506
17	16	3	0	1304	4988	3684	2639.667	1665.75	7919	3	1304	1304	1627
18	17	2	0	1366	1664	298	1515	149	3030	2	1366	1366	1366
19	18	2	0	3668	3975	307	3821.5	153.5	7643	2	3668	3668	3668
20	19	2	0	1352	1573	221	1462.5	110.5	2925	2	1352	1352	1352

Red font rows are pasted from second table



# Forest Carbon Model Building Using SAR

- Copy data from attribute table of final\_fielddata\_agb\_gcs\_buff19m.shp and paste in the same excel sheet.

OBJECTID	FID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN	FID	Shape *	plot_id	X	Y	trees_no	AGB_t_plc	AGB_tha	C_t_plot	C_tha_1	BUFF_DIS	ORIG_FID
1	0	3	0	1418	2461	1043	2111.667	490.5007	6335	3	1418	1418	2456	0	Polygon	361	90.45863	23.98668	15	9.33412	82.3032	4.38704	38.6825	19	0
2	1	3	0	493	1932	1439	1098.333	609.2522	3295	3	493	493	870	1	Polygon	363	90.35863	23.93668	11	5.75053	50.705	2.70275	23.8313	19	1
1	2	3	0	2641	3670	1029	3242.667	437.8008	9728	3	2641	2641	3417	2	Polygon	365	90.40863	24.08668	78	61.0554	538.353	28.696	253.026	19	2
2	3	3	0	1603	2588	985	2240.667	451.4985	6722	3	1603	1603	2531	3	Polygon	367	90.39196	24.03668	4	1.6424	14.4817	0.771925	6.80641	19	3
3	4	3	0	2424	3442	1018	3102.333	479.6543	9307	3	2424	2424	3441	4	Polygon	368	90.35863	24.03668	16	7.14633	63.0124	3.35878	29.6158	19	4
4	5	3	0	3083	3780	697	3328.667	319.5584	9986	3	3083	3083	3123	5	Polygon	369	90.44196	24.13668	52	85.5085	753.967	40.189	354.364	19	5
5	6	2	0	2853	5292	2439	4072.5	1219.5	8145	2	2853	2853	2853	6	Polygon	370	90.3753	24.11168	43	55.4418	488.855	26.0577	229.762	19	6
3	7	3	0	1934	5130	3196	3376	1323.282	10128	3	1934	1934	3064	7	Polygon	371	90.40863	23.93668	10	7.26218	64.0339	3.41322	30.0959	19	7
6	8	3	0	2419	4366	1947	3534	819.6621	10602	3	2419	2419	3817	8	Polygon	372	90.34196	24.13668	18	19.0138	167.653	8.93647	78.7968	19	8
7	9	2	0	571	1077	506	824	253	1648	2	571	571	571	9	Polygon	373	90.25863	24.11168	34	26.414	232.904	12.4146	109.465	19	9
8	10	2	0	2345	5286	2941	3815.5	1470.5	7631	2	2345	2345	2345	10	Polygon	374	90.1753	24.01168	4	1.1959	10.5448	0.562075	4.95607	19	10

- To calculate backscattered coefficient ( $\gamma^\circ$ ), use the following formula;

$$\gamma^\circ(\text{dB}) = 10 \log_{10} \langle \text{DN}^2 \rangle - 83.0$$

where DN is the digital number expressed in the unsigned short integer in the data that represents amplitude of the radar backscatters.

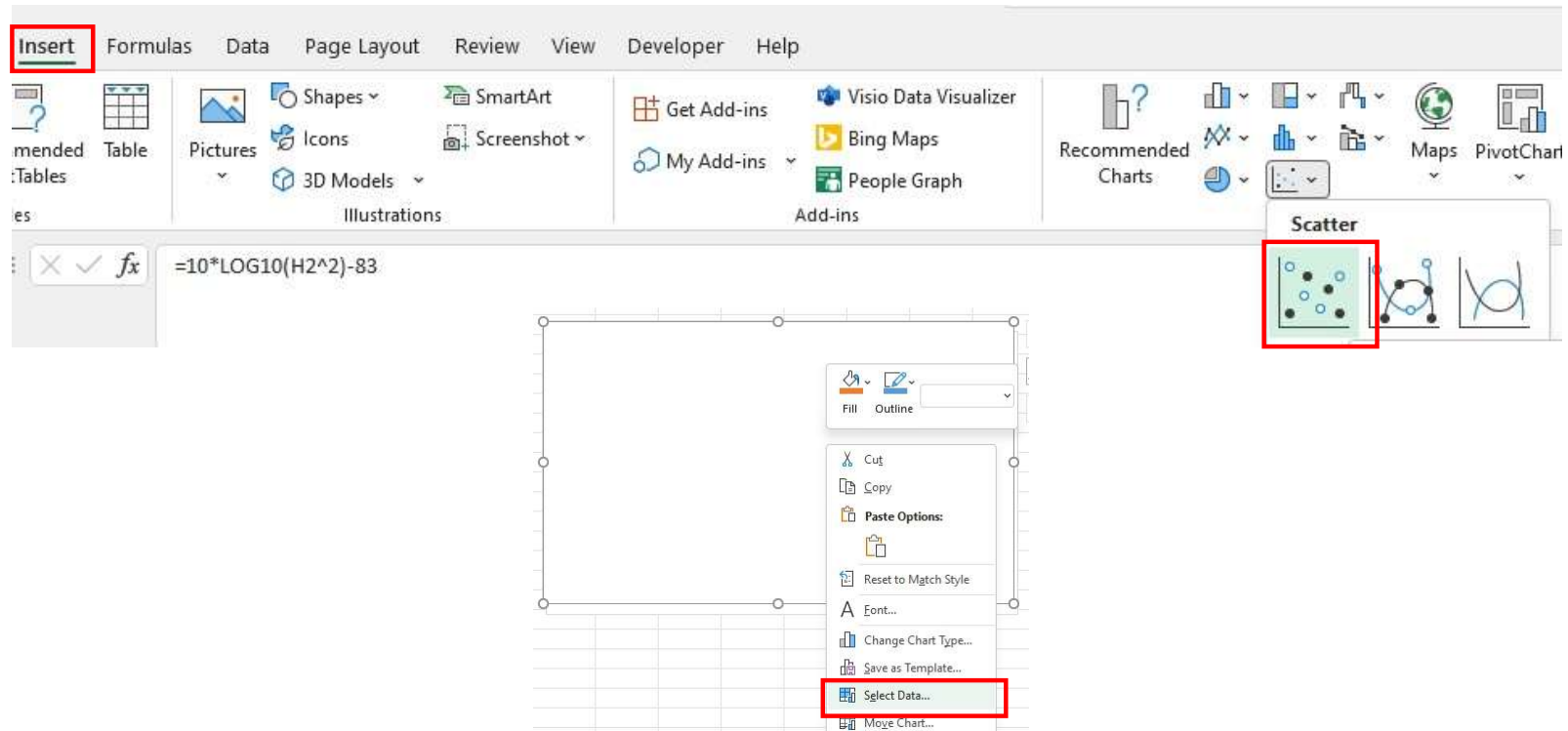
	B	H	U	V	W	X	AA
1	FID	MEAN	AGB_t_plot	AGB_tha	C_t_plot	C_tha_1	dB_HV
2	0	2111.667	9.33412	82.3032	4.38704	38.6825	-16.5075
3	1	1098.333	5.75053	50.705	2.70275	23.8313	-22.1853
4	2	3242.667	61.0554	538.353	28.696	253.026	-12.782



# Forest Carbon Model Building Using SAR

## Assess the correlation between backscattered coefficient and field based AGB

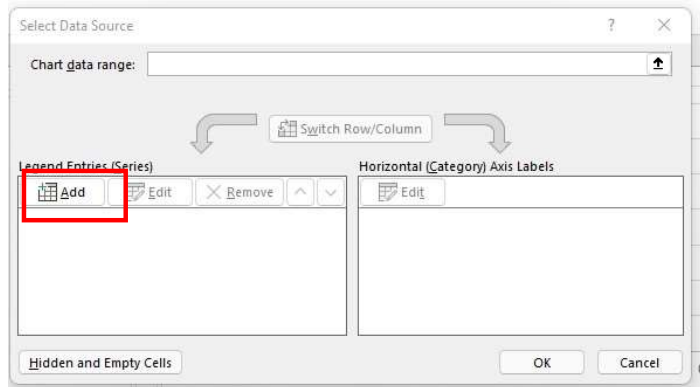
- In the excel sheet, go to insert > charts > Scatter
- Select the chart, go to select data
- backscattered coefficient column at X and AGB at Y



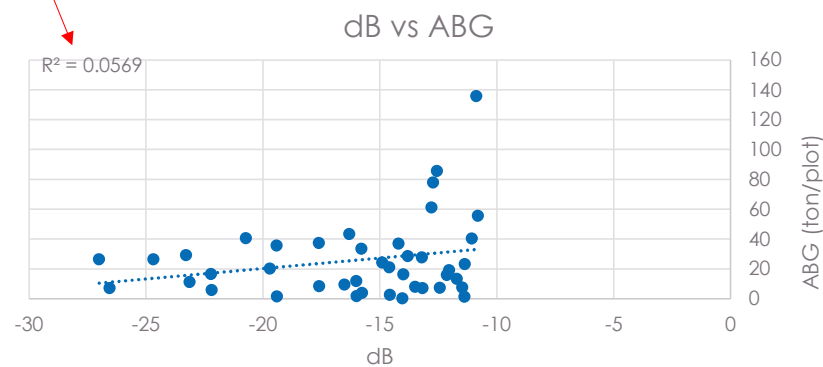
# Forest Carbon Model Building Using SAR

Assess the correlation between backscattered coefficient and field based AGB

- Go to **Add** and select backscattered coefficient column at X and AGB at Y
- Select points on the graph > right click > Add Trendline > Select trendline and display R-squared value on chart



	B	H	U	V	W	X	AA	AB	AC	AD	AE	AF
1	FID	MEAN	AGB_t_plot	AGB_tha_	C_t_plot	C_tha_1	dB_HV					
2		0	2111.667	9.33412	82.3032	4.38704	38.6825	-16.5075				
3		1	1098.333	5.75053	50.705	2.70275	23.8313	-22.1853				
4		2	3242.667	61.0554	538.353	28.696	253.026	-12.782				
5		3	2240.667	1.6424	14.4817	0.771925	6.80641	-15.9925				
6		4	3102.333	7.14633	63.0124	3.35878	29.6158	-13.1662				
7		5	3328.667	85.5085	753.967	40.189	354.364	-12.5546				
8		6	4072.5	55.4418	488.855	26.0577	229.762	-10.8028				
9		7	3376	7.26218	64.0339	3.41322	30.0959	-12.432				
10		8	3534	19.0138	167.653	8.93647	78.7968	-12.0347				

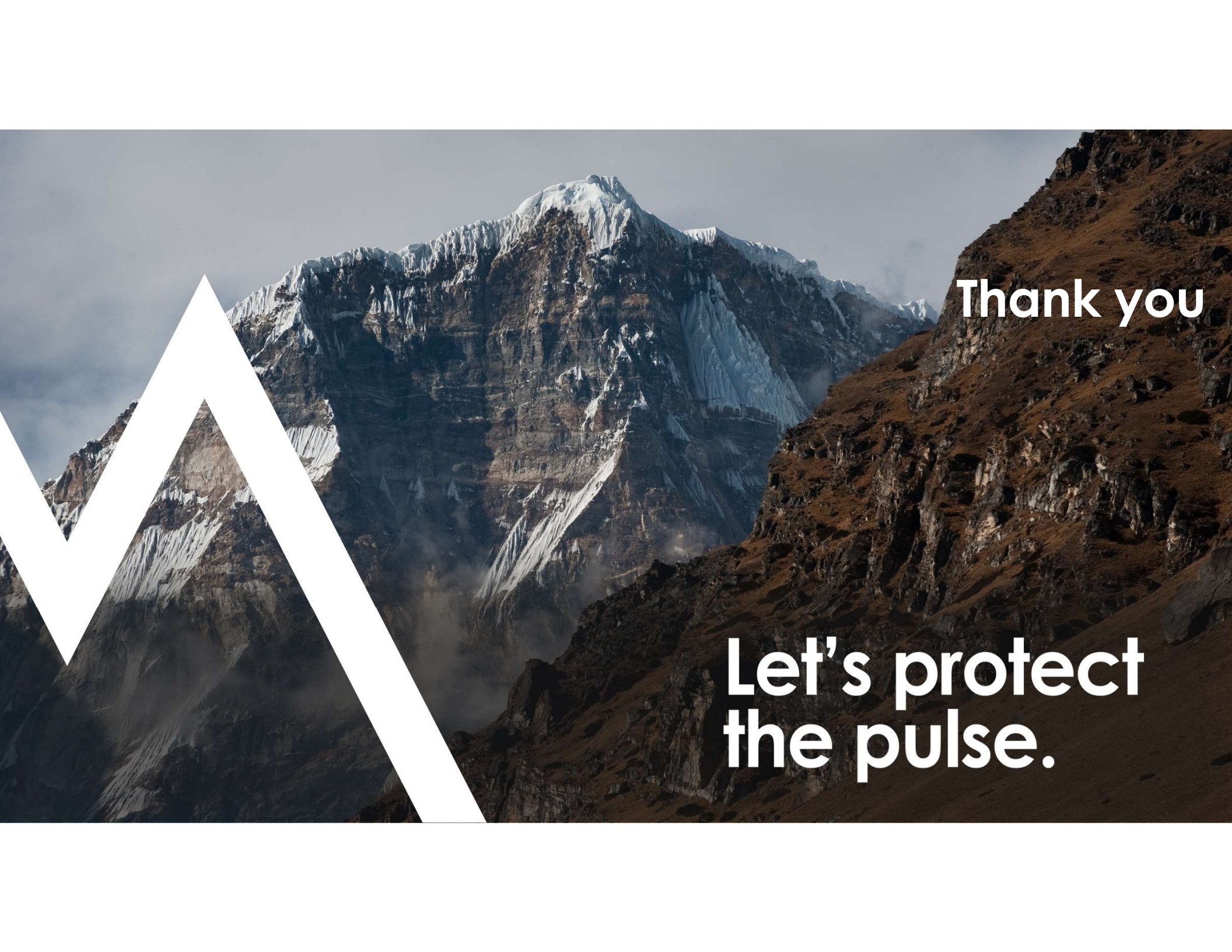


# Forest Carbon Model Building Using SAR

## Assignments

- Assess the correlation between backscattered coefficient (HH) and field based AGB
- Assess the correlation between Processed Sentinel 1 (for both HH and HV) and field based AGB





**Thank you**

**Let's protect  
the pulse.**