Article

Vegetation Cover Dynamics in the High Atlas Mountains of Morocco

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Supplementary Materials

Table S1. List of data sources using for SVM method as Dataset 1.

Year	Date	Bands	Sensor	Row	Path	Datum	UTM Zone	Cloud cover:
1990	07/11/1990	7	Landsat 5	37	200	"WGS84"	30	Less than 10%
1990	07/11/1990	7	Landsat 5	38	200	"WGS84"	30	Less than 10%
1990	07/29/1990	7	Landsat 5	38	198	"WGS84"	30	Less than 10%
1990	08/17/1990	7	Landsat 5	39	203	"WGS84"	30	Less than 10%
1990	08/26/1990	7	Landsat 5	38	202	"WGS84"	30	Less than 10%
1990	08/26/1990	7	Landsat 5	39	202	"WGS84"	30	Less than 10%
1990	09/04/1990	7	Landsat 5	38	201	"WGS84"	30	Less than 10%
1990	09/22/1990	7	Landsat 5	37	199	"WGS84"	30	Less than 10%
1990	09/22/1990	7	Landsat 5	38	199	"WGS84"	30	Less than 10%
2000	06/17/2000	7	Landsat 5	39	203	"WGS84"	30	Less than 10%
2000	07/07/2000	7	Landsat 5	37	199	"WGS84"	30	Less than 10%
2000	08/06/2000	7	Landsat 5	38	201	"WGS84"	30	Less than 10%
2000	08/13/2000	7	Landsat 5	38	202	"WGS84"	30	Less than 10%
2000	08/13/2000	7	Landsat 5	39	202	"WGS84"	30	Less than 10%
2000	08/16/2000	7	Landsat 5	38	199	"WGS84"	30	Less than 10%
2000	08/23/2000	7	Landsat 5	38	200	"WGS84"	30	Less than 10%
2000	08/25/2000	7	Landsat 5	38	198	"WGS84"	30	Less than 10%
2010	05/24/2010	7	Landsat 5	37	199	"WGS84"	30	Less than 10%
2010	05/24/2010	7	Landsat 5	38	199	"WGS84"	30	Less than 10%
2010	06/18/2010	7	Landsat 5	38	198	"WGS84"	30	Less than 10%
2010	06/21/2010	7	Landsat 5	39	203	"WGS84"	30	Less than 10%
2010	06/23/2010	7	Landsat 5	38	201	"WGS84"	30	Less than 10%
2010	06/30/2010	7	Landsat 5	38	202	"WGS84"	30	Less than 10%
2010	07/16/2010	7	Landsat 5	39	202	"WGS84"	30	Less than 10%
2010	09/04/2010	7	Landsat 5	37	200	"WGS84"	30	Less than 10%
2010	09/04/2010	7	Landsat 5	38	200	"WGS84"	30	Less than 10%

2020	06/02/2020	8	Landsat 8	38	201	"WGS84"	30	Less than 10%
2020	06/20/2020	8	Landsat 8	37	199	"WGS84"	30	Less than 10%
2020	07/06/2020	8	Landsat 8	38	199	"WGS84"	30	Less than 10%
2020	07/18/2020	8	Landsat 8	39	203	"WGS84"	30	Less than 10%
2020	07/31/2020	8	Landsat 8	38	198	"WGS84"	30	Less than 10%
2020	08/28/2020	8	Landsat 8	38	202	"WGS84"	30	Less than 10%
2020	08/28/2020	8	Landsat 8	39	202	"WGS84"	30	Less than 10%
2020	09/15/2020	8	Landsat 8	37	200	"WGS84"	30	Less than 10%
2020	09/15/2020	8	Landsat 8	38	200	"WGS84"	30	Less than 10%

Table S2. Threshold of NDVI, sliced from range for low and high NDVI classes at lowest or highest 70% to define the threshold as dominant values.

Low NDVI								High NDVI							
Jan		*Apr*		*Aug*		*Oct*		*Jan*		*Apr*		*Aug*		*Oct*	
Mean	0,15	Mean	0,16	Mean	0,12	Mean	0,15	Mean	0,47	Mean	0,64	Mean	0,50	Mean	0,51
Standard	0,00	Standard	0,00	Standard	0,00	Standard	0,00	Standard	0,01	Standard	0,02	Standard	0,02	Standard	0,01
Median	0,15	Median	0,16	Median	0,12	Median	0,15	Median	0,47	Median	0,68	Median	0,53	Median	0,53
Mode	0,13	Mode	0,15	Mode	0,12	Mode	0,15	Mode	0,48	Mode	0,81	Mode	0,42	Mode	0,63
Standard	0,04	Standard	0,04	Standard	0,04	Standard	0,03	Standard	0,12	Standard	0,15	Standard	0,16	Standard	0,11
Sample V	0,00	Sample V	0,00	Sample V	0,00	Sample V	0,00	Sample V	0,01	Sample V	0,02	Sample V	0,03	Sample V	0,01
Kurtosis	2,04	Kurtosis	0,64	Kurtosis	1,32	Kurtosis -	0,20	Kurtosis -	0,93	Kurtosis -	0,52	Kurtosis -	0,56	Kurtosis -	0,41
Skewnes -	1,18	Skewnes	0,54	Skewnes -	1,03	Skewnes	0,02	Skewnes	0,12	Skewnes -	0,75	Skewnes -	0,46	Skewnes -	0,32
Range	0,21	Range	0,20	Range	0,19	Range	0,15	Range	0,48	Range	0,58	Range	0,68	Range	0,53
Minimun	0,01	Minimun	0,09	Minimun	-	Minimun	0,08	Minimun	0,23	Minimun	0,27	Minimun	0,10	Minimun	0,24
Maximun	0,22	Maximun	0,29	Maximun	0,19	Maximun	0,23	Maximun	0,71	Maximun	0,85	Maximun	0,78	Maximun	0,77
Sum	11,29	Sum	13,09	Sum	9,47	Sum	11,84	Sum	43,76	Sum	59,00	Sum	47,10	Sum	48,24
Count	77,00	Count	80,00	Count	80,00	Count	80,00	Count	94,00	Count	92,00	Count	94,00	Count	94,00
Largest(5	0,13	Largest(5	0,14	Largest(5	0,10	Largest(5	0,13	Largest(6	0,38	Largest(6	0,59	Largest(6	0,42	Largest(6	0,46
Smallest(	0,17	Smallest(	0,18	Smallest(	0,14	Smallest(	0,16	Smallest(	0,53	Smallest(	0,75	Smallest(	0,61	Smallest(	0,59
Confiden	0,01	Confiden	0,01	Confiden	0,01	Confiden	0,01	Confiden	0,03	Confiden	0,03	Confiden	0,03	Confiden	0,02

Table S3. T-test between NDVI of four vegetation types in April and August 2022 in the High Atlas Mountains of Morocco.

Group Name	N	Missing	Mean	Std Dev	SEM
Tree very dense	22	0	0,09	0,13	0,028
Tree dense	20	0	0,06	0,09	0,021
Crop and Tree	23	0	0,15	0,19	0,039
Crop	29	0	0,19	0,15	0,029
Source of Variation	**DF**	**SS**	**MS**	**F**	**P**
Between Groups	3	0,258	0,086	3,797	0,013
Residual	90	2,041	0,022		
Total	93	2,3			

Table S4. List of Dataset 2 including Landsat 5 and Land 8 (30mx30m) WGS84, UTM 30, downloaded from USGS.

| Year	Path	Row	Date	Year	Path	Row	Date	Year	Path	Row	Date	Year	Path	Row	Date
July-August				July-August				July-August				July-August			
2020	198	38	15/07	1990	198	38	30/08	2000	198	38	09/08	2010	198	38	05/08
2020	199	37	07/08	1990	199	37	20/07	2000	199	37	x	2010	199	37	27/07
2020	199	38	06/07	1990	199	38	05/08	2000	199	38	16/08	2010	199	38	12/08
2020	200	37	29/07	1990	200	37	27/07	2000	200	37	07/08	2010	200	37	03/08
2020	200	38	13/07	1990	200	38	11/07	2000	200	38	07/08	2010	200	38	03/08
2020	201	38	05/08	1990	201	38	19/08	2000	201	38	13/07	2010	201	38	25/07
2020	202	38	12/08	1990	202	38	10/8	2000	202	38	04/07	2010	202	38	16/07
2020	202	39	12/08	1990	202	39	10/08	2000	202	39	04/07	2010	202	39	16/07
2020	203	39	03/08	1990	203	39	x	2000	203	39	x	2010	203	39	x
Dec-Jan				Dec-Jan				Dec-Jan				Dec-Jan			
2020	198	38	05/01	1990	198	38	18/01	2000	198	38	13/12	2010	198	38	09/01
2019	199	37	27/12	1990	199	37	25/01	2000	199	37	05/01	2010	199	37	15/12
2019	199	38	08/12	1990	199	38	25/01	2000	199	38	20/12	2010	199	38	16/01
2020	200	37	03/01	1990	200	37	15/12	2000	200	37	11/12	2010	200	37	06/12
2020	200	38	03/01	1990	200	38	15/12	2000	200	38	11/12	2010	200	38	06/12
2019	201	38	09/12	1990	201	38	23/01	2000	201	38	18/12	2010	201	38	30/01
2019	202	38	16/12	1990	202	38	14/01	2000	202	38	26/01	2010	202	38	21/01
2020	202	39	17/01	1990	202	39	14/01	2000	202	39	x	2010	202	39	21/01
2020	203	39	08/01	1990	203	39	x	2000	203	39	x	2010	203	39	x
March-April				March-April				March-April				March-April			
2020	198	38	26/4	1990	198	38	23/03	2000	198	38	x	2010	198	38	30/03
2020	199	37	16/03	1990	199	37	15/04	2000	199	37	25/03	2010	199	37	06/04
2020	199	38	16/03	1990	199	38	15/04	2000	199	38	25/03	2010	199	38	22/04
2020	200	37	07/03	1990	200	37	21/03	2000	200	37	01/04	2010	200	37	x
2020	200	38	07/03	1990	200	38	21/03	2000	200	38	01/04	2010	200	38	12/03
2020	201	38	15/04	1990	201	38	28/03	2000	201	38	08/04	2010	201	38	20/04
2020	202	38	22/04	1990	202	38	20/04	2000	202	38	15/04	2010	202	38	10/03
2020	202	39	22/04	1990	202	39	20/04	2000	202	39	x	2010	202	39	x
2020	203	39	29/04	1990	203	39	x	2000	203	39	x	2010	203	39	x
Oct-Nov				Oct-Nov				Oct-Nov				Oct-Nov			
2020	198	38	03/10	1990	198	38	18/11	2000	198	38	13/11	2010	198	38	25/11
2020	199	37	11/11	1990	199	37	24/10	2000	199	37	20/11	2010	199	37	16/11
2020	199	38	11/11	1990	199	38	24/10	2000	199	38	20/11	2010	199	38	16/11
2020	200	37	17/10	1990	200	37	31/10	2000	200	37	11/11	2010	200	37	23/11
2020	200	38	01/10	1990	200	38	31/10	2000	200	38	11/11	2010	200	38	23/11
2020	201	38	24/10	1990	201	38	06/10	2000	201	38	17/10	2010	201	38	14/11
2020	202	38	31/10	1990	202	38	14/11	2000	202	38	08/10	2010	202	38	15/11
2020	202	39	31/10	1990	202	39	14/10	2000	202	39	x	2010	202	39	15/11
2020	203	39	07/11	1990	203	39	04/10	2000	203	39	x	2010	203	39	12/11

Figure S1. Dynamics of land-use in High Atlas using the SVM method
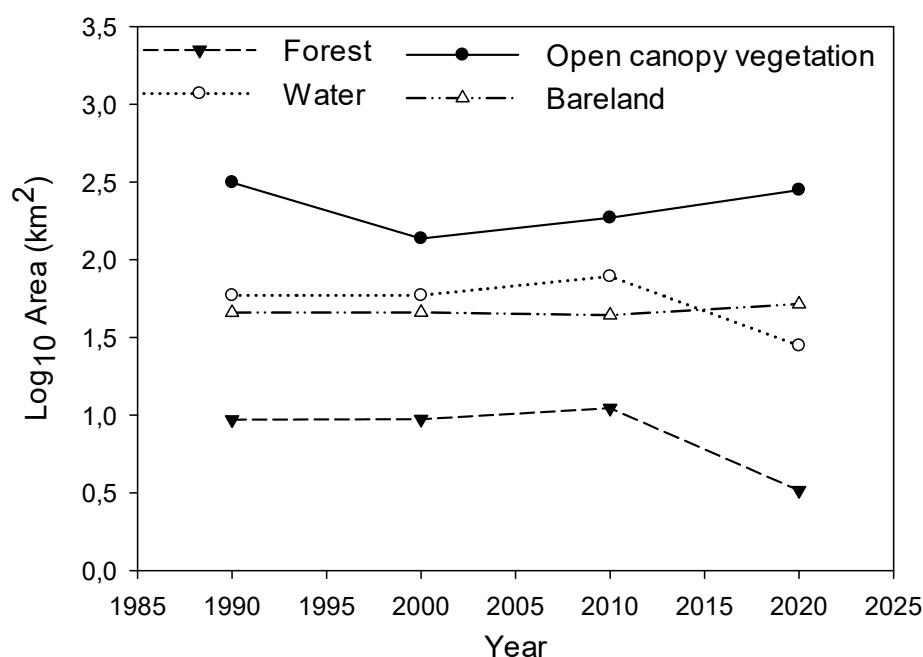
Figure S2. Distribution of low and high NDVI in the study region of the High Atlas Mountains of Morocco.
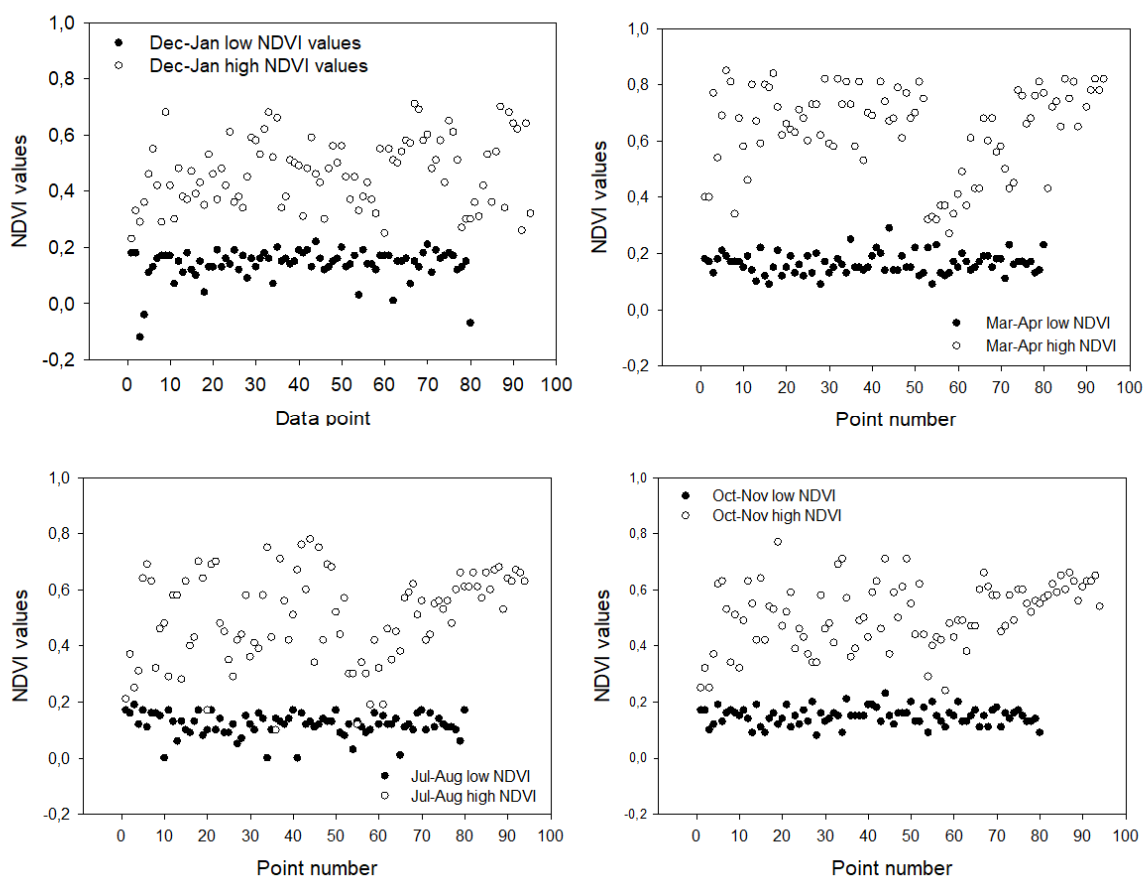
Figure S3. Two examples of field data collection in the High Atlas of Morocco in 2020
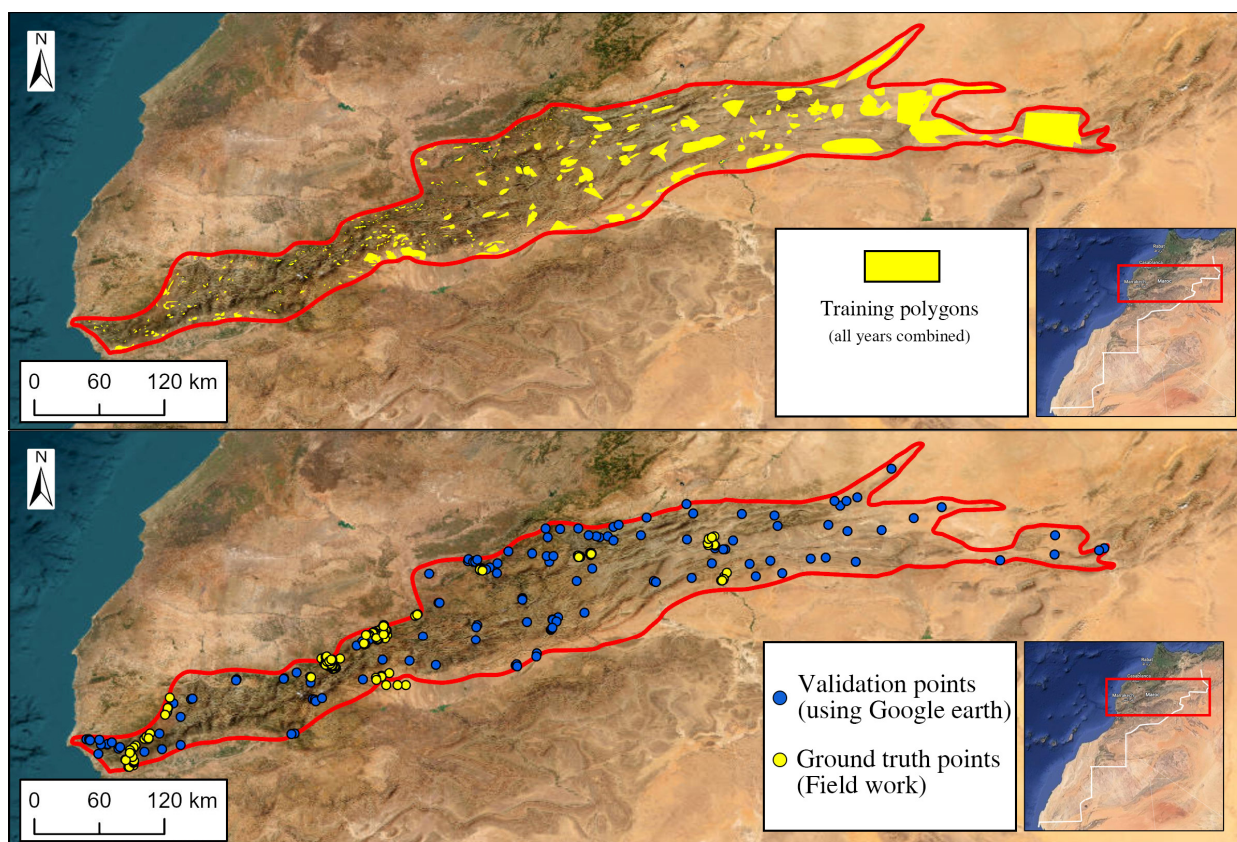
Figure S4. Examples of NDVI maps in 2020 during four seasons in the High Atlas of Morocco in 2020.