

# **A Geographical Analysis of Challakere Amrit Mahal Kaval Grasslands. Using Remote Sensing and GIS Technologies**

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## **ABSTRACT**

The Amrit Mahal Kaval grassland is a protected area dedicated to conservation of Amrit Mahal, an endangered breed of cattle that originated from the erstwhile state of Mysore in Karnataka. Nearly 14519 acres of grassland is reserved which is enriched with biodiversity and grassland ecosystem as well and with over 450 years of history. Thus, such kind of research on grasslands is important and also inevitable. Another important point to be noticed is that, this area was portrayed as barren land and in the year 2007, a report was prepared and submitted to the state government permitting Defense and other departments to use these 11400 acres of Amrit Mahal Kaval Grasslands which led to several impact on the biodiversity in this area. Remote sensing and GIS technologies were used to study the impact on grasslands in terms of Social, Cultural, Economic and Environmental changes between 2009 to 2019. By looking at the statistics of the Challakere Amrit Mahal Kaval grasslands it is evident that the developmental work carried out here has led to the loss of 4.59% of the vegetation area, 0.29% of the water sources and 24.6% of the pasture land. The Study focuses not only on the impact of biodiversity in that area but also on the social life of people. In today's condition both development and ecological balance are important but at the same time it is really hazardous to suppress ecology in the name of development. Compromising ecology for development is proven inimical. It is the need of the hour to protect Amrit Mahal Kaval grasslands as it provides an important habitat for many endangered species like the Great Indian Bustard and Amrit Mahal cattle breed.

*Keywords: Amrit Mahal Grasslands; Communities; Biodiversity; Remote Sensing and GIS*

## **1. INTRODUCTION**

Human encroachment on the Grasslands is on the rise globally. Karnataka's population stands at 6,11,30,704 according to population census of 2011. The population density stands at 319 per square kilometer of total geographical area of Karnataka [1]. Urban development is putting tremendous pressure on natural resources directly. Increasing population has resulted in building huge cities and encroaching grasslands, grazing pastures (Gomalas), forests, plantations, farmlands, ponds and lakes [2,4]. This impact is no different for Challakere Amrit Mahal Kaval grassland.

Since the time of Vijayanagara Empire, the hardy and draught resistant Amrit Mahal cattles have roamed freely and adapted to the heat of the open space and rough terrain of the hillocks [5]. The natural grassland areas specifically protected for grazing Amrit Mahal breed gave them the name Amrit Mahal Kaval [6]. Probably, this is the only largest grassland devoted to the protection of a species of cattle anywhere in the world.

When the state of Karnataka was established, the Kaval grasslands spread over 4 Lakh acres. But now, it has diminished to just 60000 acres. That means, in 6 decades the

reputation of destroying 3 Lakh acres of Kaval grasslands is on us [7,8]. Instead of protecting our proud Amrit Mahal Cattle, we are destroying its habitat spanning several districts like Mysore, Mandya, Tumkur, Chitradurga, Hassan, Chikmagalur and so on, we have made great strides in destroying the grasslands [9]. Forest Department, unaware of the importance of grasslands, has planted Eucalyptus over thousands of acres resulting in the destruction of Amrit Mahal Kaval grasslands [10]. Thus, amidst the pressure, the remaining 60000 acres of surviving grasslands has widened the eyes of Central and State Governments along with land mafias [11].

For example, in 2007 respective State and Central Ministers wrote a letter to Ministry of Defence making them believe that grassland is a ruined place, a wasteland and is best suited to build airplanes in Chitradurga's Challakere Amrit Mahal Kaval Grassland areas. There is no question of alienating people here, land is infertile for agriculture practices and there is no need of paying compensation. Hence it best suited for a Defense Ministry setup. With the help of Member of Parliament, the District Commissioner prepared and submitted a plan to give away 10000 acres of Kaval grasslands which got approved from the State Government. Getting land in the name of safety of the country is very easy. Under this, other government departments and land mafia lobby joined hands [12]. In this article, it is stated, how Indian Institute of Science, Indian Space Research Organization, Nuclear Power Corporation of India along with Defense Ministry organizations and some private companies systematically destroyed a micro ecosystem of great importance [13,14]. Amrit Mahal Kaval, which has a history of nearly 500 years devoted to the protection of one species of cattle is one of its kind in the entire world. The entire landscape has been destroyed creating problems of biodiversity, social, cultural and economic factors. Land use changes from the development work in the Chalakkere Amrit Mahal Kaval grasslands after 2009 have been evaluated using remote sensing and GIS technology.

Main objective of this study is to demarcate Challakere Amrit Mahal Kaval grassland boundary. To study, currently what kind of development is happening in grassland areas and analyzing ten years Land-Use and Land-Cover Change (LU&LCC) about past and present conditions. To analyze the effect on Environmental and social factors from unscientific development undertaken in encroached grassland and to study the disadvantages of development on biodiversity.

## History

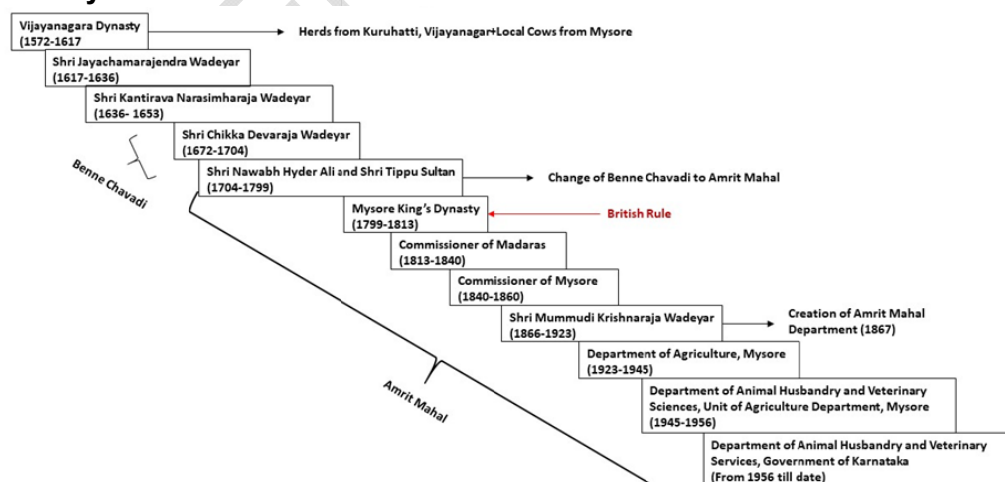


Fig. 1. Diagram of Amrit Mahal Kaval Grassland History in Karnataka

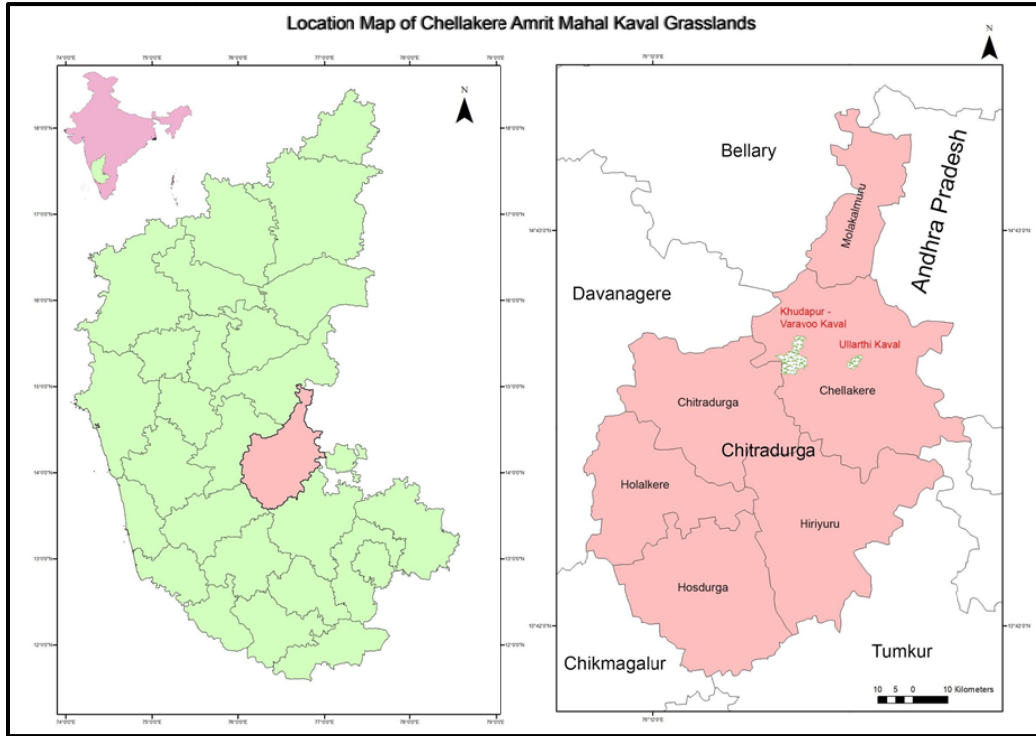
Accounts of many huge traces of Amrit Mahal Breed and their grazing grassland pastures is available by searching through 450 years history of Vijayanagara empires and Mysore empires (Fig. 1).

Since Vijayanagara Empire (1572) Karnataka's Amrit Mahal Kaval grasslands of dry regions are referred as "Kuruhatti". Later from 1617 to 1637 during Shri Jayachamarajendra Wodeyar VI, 1637 to 1638 Shri Raja Wodeyar II, 1638 to 1653 Shri Narasaraja Wodeyar I (RanadheeraKanteerava) and 1654 to 1672 Shri Doddadevaraja Wodeyar of Mysore Empire brought the native breed Amrit Mahal of Vijayanagara Empire to Mysore Empire. To graze the breeds, they identified large tracts of grasslands in the Mysore Empire and preserved the same. These are called and referred as Amrit Mahal Kaval (Kaval Grassland Area). During 1672-1704 under Mysore Ruler Shri Chikkadevaraja Wodeyar, Amrit Mahal Kavals were developed. About 240 places in the empire over 4,13,529 acres of grasslands were identified and that area were called as "Bennichavadi" [15]. After Wodeyar's rule, during the period of 1704 to 1799, Hyder Ali and Tippu Sultan, 60000 Amrit Mahal Cattle were there. During Tippu's rule "Bennichavadi" was renamed as "Amrit Mahal".

Cattle breed better empowered than Horses used by Tippu Sultan in war was also a reason for his victory. After Anglo–Mysore War IV (1798-1799) fought between Mysore Empire and East India Company, Amrit Mahal Kaval Grasslands came under administration of East India Company administration. During 1799-1813, under British rule, realizing the uniqueness of the breed, they set out to preserve it. In 1813 under the command of British Officer, Madras Commissioner 'Captain Harvey', a plan was implemented for the conservation of the breed[14]. Later during 1813-1860, the Madras and Mysore commissioners had a number of projects for Amrit Mahal livestock and the breed sustained. In 1867 Shri Mummudi Krishnaraja Wodeyar created a whole new "Amrit Mahal Department" under which there were 5395 Amrit Mahal cattles [16]. Joint District Collector of Mysore and Superintendent of Amrit Mahal Department gave away 69,007 acres out of 3,95,062 acres Amrit Mahal grasslands to farmers at Darakast in 1915-16 at the behest of the Government. Of government order, in 1918, 1,24,903.35 acres were handed over to the Revenue Department. Then from 1923-1945, the Mysore State Department of Agriculture looked after the Amrit Mahal Kaval and Livestock. From 1945-1956, the Department of Animal Husbandry and Veterinary Medicine of Mysore State were also involved. In 1956, the government ordered to distribute 92,801 acres of land over 1,65,000 acres to farmers and other development activities. From 1956 to present, under Karnataka Government's animal husbandry and veterinary science departments, 65,925.36 acres of Amrit Mahal Kaval is distributed amongst 6 districts and 62 places of Chikkamagaluru, Chitradurga, Hassan, Tumkur, Mandya and Davanagere. The present article is about Amrit Mahal Kaval Grassland of Challakere of Chitradurga [9].

## 2. MATERIAL

### 2.1 Study Area



**Fig. 2. Location map of Challakere Amrit Mahal Kaval Grasslands**

Amrit Mahal Kaval Grassland area consists of three (3) neighboring villages namely; Khudapur Kaval with a total of 2971 acres, Varavoo Kaval with 9370 acres and Ullarathi Kaval with 2178 acres. Challakere Amrit Mahal Kaval Grassland area comes under Challakere Taluk of Chitradurga district. This area falls under Central Dry Zone. The study area is located in Karnataka, India with Latitude of  $14^{\circ} 27' 30''$  N to  $14^{\circ} 20' 30''$  N and  $76^{\circ} 30' 30''$  E to  $76^{\circ} 44' 30''$  E Longitude (Fig. 2).

### 2.2 Methods

The two sets of remote sensing data used for this study include: LANDSAT\_5 (The Thematic Mapper sensor) and LANDSAT\_8 (Operational Land Imager\_ Thermal Infrared Sensor) and other materials used are Land Use and Land Cover changes. The details of the data used are given in table1.

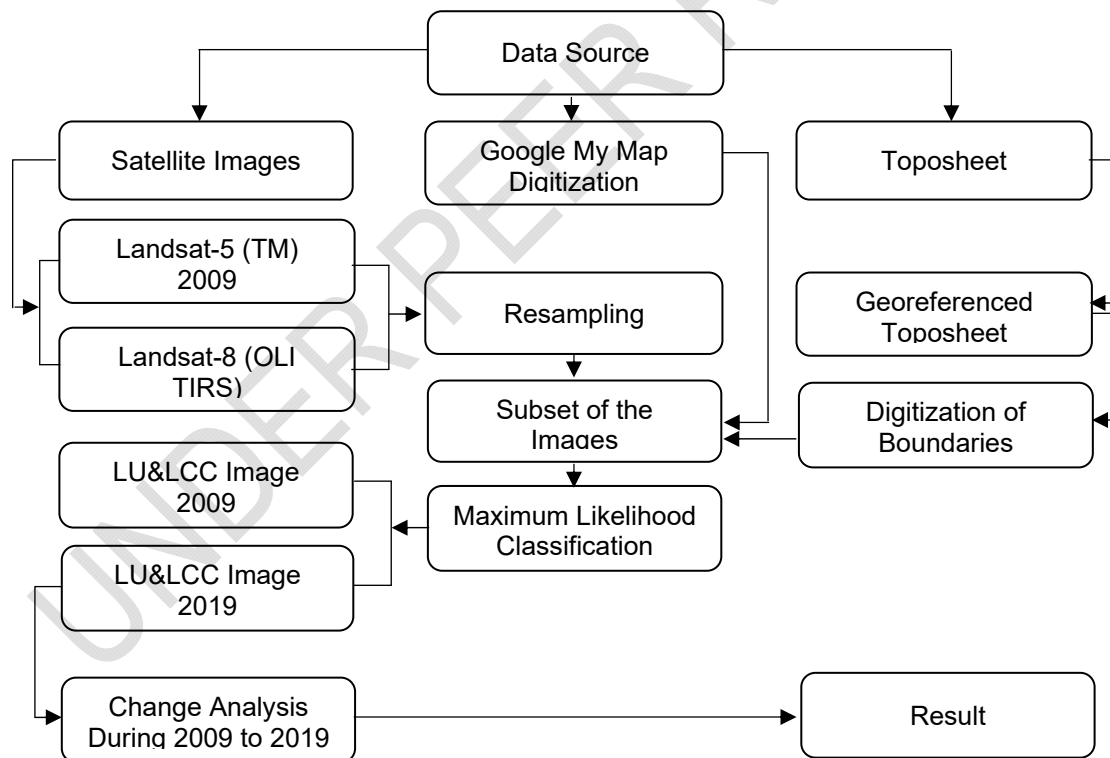
1. Preliminary information gathered from villagers living around the Amrit Mahal Kaval Grasslands.
2. 1:50,000 Toposheets collected from the Geological Survey of India, Koramangala, Bengaluru.
3. Landsat Satellite Images collected from USGS website.

**Table 1. Information of the satellite images used for the preparation of land use and land cover maps.**

Sl.No.	Data type	Date of acquisition	Path-Row	Resolution (m)	Number of bands	Source
1	LANDSAT_5 (TM)	03-01-2009	145/050	30	7	USGS
2	LANDSAT_8 (OLI_TIRS)	16-02-2019	145/050	30	11	USGS

OLI: Operational Land Imager; TM: Thematic Mapper; USGS: United States Geological Survey.

The following methodology was used for land use and land cover change detection over the specified years 2009 and 2019. First, Landsat Thematic Mapper (TM) and Operational Land Imager Thermal Infrared Sensor (OLI TIRS) Images (with path/row 145/050) acquired on 03 January 2009 and 16 February 2019 respectively were used in the study. The scale of the study area map used for the analysis was drawn on 1:50000 ratio. The image resolution was 30 meters for pixel, land use and land cover classification were carried out by using the supervised classification following maximum likelihood method, using ArcGIS 10.1 software. The land use and land cover classes classified for the study namely vegetation, water bodies, grassland, solar area, runway, buildings, roads, boundary walls and disturbed area. Fig. 3 describes the overall methodology[17,18].



**Fig. 3. Flowchart of methodologies for Land Use & Land Cover Change mapping**

### 3. RESULTS AND DISCUSSION

14,500 acres of Protected Area (PA), a unique grassland ecosystem harboring vast biodiversity, is preserved over centuries specifically for the World's most endangered special breed of cattle, the Amrit Mahal.

Table 2,3 and 4 has info on the allotted organizations with its purpose and total area allotted for each organization.

In **Khudapur Kaval**: Indian Institute of Science (IISC) 1557 acres, Talent Development Centre (TDC) 290 acres, Bhabha Atomic Research Centre (BARC) 402 acres, Defence Research and Development Organization (DRDO) 224 acres, Karnataka Housing Board (KHB) 110 acres, Indian Space Research Organization (ISRO) 100 acres, Industrial Park 147 acres of area has been allocated. In total, out of 2971 acres, 2830 acres have been allocated. Only 141 acres remain.

In **Varavoo Kaval**: Out of 9366 acres, Defence Research and Development Organization (DRDO) 4028 acres, Sagitaur Ventures India Pvt.Ltd. (Solar Park) 1003 acres, National Aerospace Laboratories (NAL) 583 acres, Upper Bhadra Project 877 acres. In total, out of 9370 acres, 6491 acres have been allocated. Only 2879 acres remain.

In **Ullarthi Kaval**: Indian Space Research Organization (ISRO) 464 acres, Bhabha Atomic Research Centre (BARC) 1420 acres, Karnataka State Small Industries Development Corporation Ltd. (KSSIDC) 276 acres, Goshale 3 acres. In total, out of 2178 acres, 2163 acres have been allocated. Only 15 acres remain.

In 2007 State and Central Governments have donated a total of 11484 acres of geographical area to the above institutions for Defence, Industrial, Infrastructure, Institutional and Commercial purposes [19,20].

Following Tables 2,3 and 4 gives the details of area, organizations and its purpose.

Table 2.		Khudapura Kaval			
Sl. No.	Organisation	Village Name	Sy. No.**	Extent of land in acres	Purpose
1	IISC	Khudapura	47	1557	Synchrotron, Energy Research Centre and Advanced Aerospace Research Centre.
2	BARC	Khudapura	47	402	BARC Guest House with Special Material Enrichment Facility (Uranium).
3	DRDO	Khudapura	47	224	Aeronautical Test Range (ATR) DRDO Guest House.
4	TDC (2 Campus, 106 and 184 respectively)	Khudapura	NA	290	Talent Development Centre (TDC) Guest House and Teachers Training Program Centre.
5	KHB	Khudapura		110	Karnataka Housing Board.
6	ISRO	Khudapura	47	100	Spacecraft Technologies & Spacecraft Tech Research.
7	Industrial Park	Khudapura	NA*	147	NA*
8	Remaining land	Khudapura	NA*	141	NA*
<b>Total Area</b>				<b>2971</b>	

\* Not Available \*\* Survey Number

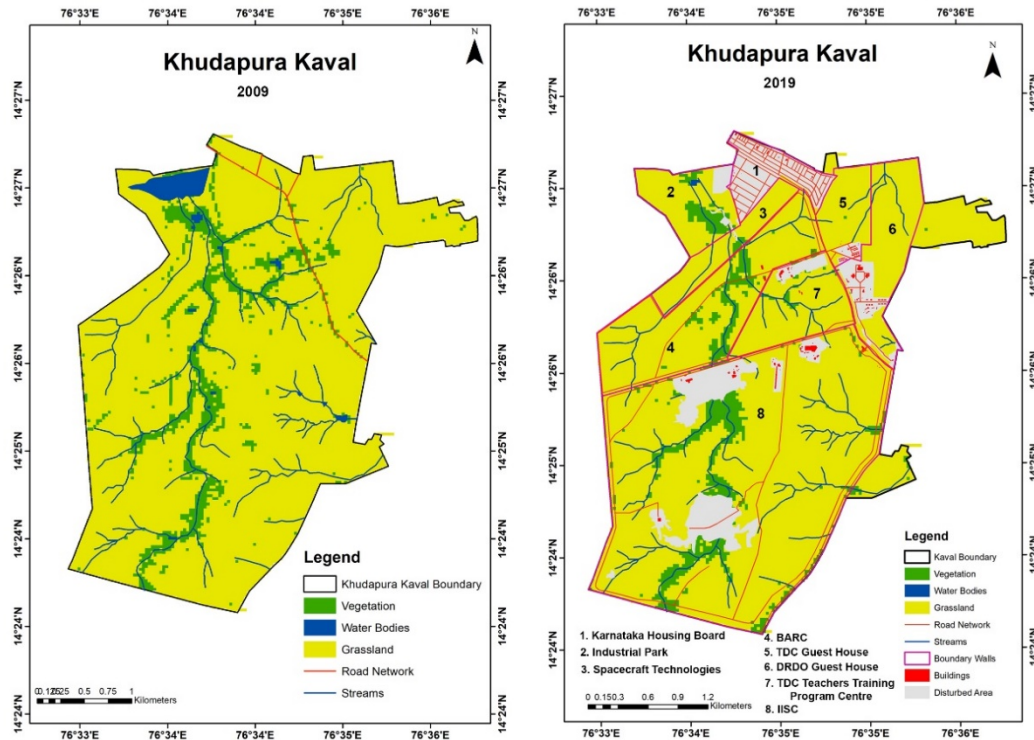
<b>Table 3. Varavoo Kaval</b>					
<b>Sl. No.</b>	<b>Overlapped Organisations</b>	<b>Village Name</b>	<b>Sy. No.**</b>	<b>Extent of land in acres</b>	<b>Purpose</b>
1	DRDO	Varavoo Kaval	343	4028	Advanced Research and Development (R&D) complex, a 3.5 kilometre Runway and Test-Centre for long-endurance (48-72 hours) Unmanned Aerial Vehicles (UAVs) and Unmanned Combat Aerial Vehicles (UCAVs). Integrated Solar Park Development along with Grid Connected 25 MW Solar PV Power Project.
2	Solar Park	Varavoo Kaval	NA*	1003	Proposed for NAL.
3	NAL	Varavoo Kaval	NA*	583	Proposed for Upper Bhadra.
4	Upper Bhadra	Varavoo Kaval	NA*	877	NA*
5	Remaining Land	Varavoo Kaval	NA*	815+2064=2879	
<b>Total Area</b>				<b>9370</b>	
* Not Available ** Survey Number					

<b>Table 4. Ullarthi Kaval</b>					
<b>Sl. No.</b>	<b>Overlapped Organisations</b>	<b>Village Name</b>	<b>Sy. No.**</b>	<b>Extent of land in acres</b>	<b>Purpose</b>
1	ISRO	Ullarthi Kaval	1	464	Spacecraft Technologies
2	BARC	Ullarthi Kaval	1	1420	Special Material Enrichment Facility (Uranium)
3	KSSIDC	Ullarthi Kaval	1	276	Various industrial ancillary units
4	GOSHALE	Ullarthi Kaval	1	3	Public Cowshed (Goshale)
5	Remaining Land	Ullarthi Kaval	NA*	15	NA*
<b>Total Area</b>				<b>2178</b>	
* Not Available ** Survey Number					

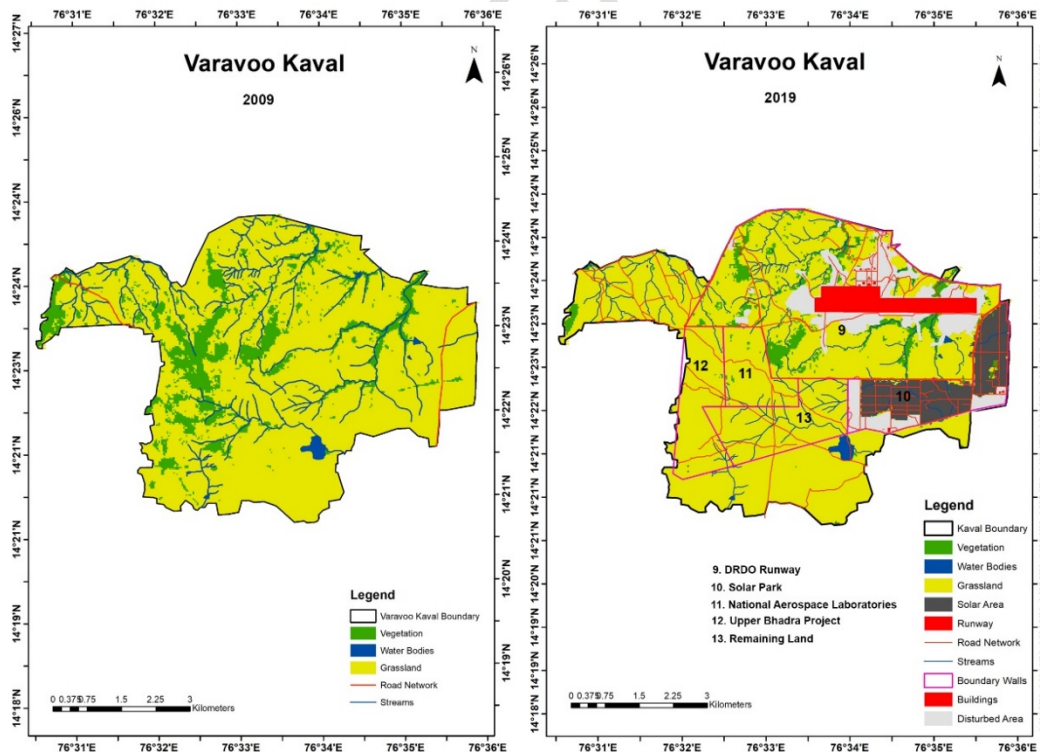
### 3.1 Land Use and Land Cover Change (LU&LCC)

The study with the use of Landsat satellite images and GIS technology, Challakere Amrit Mahal Kaval grassland's detailed ten-year land-use and land-cover, Past Condition and Present Conditions aspects can be found.

Since Challakere Amrit Mahal Kaval has been divided into 3 areas, it is easy to sort, present and explain separately amongst Khudapur Kaval, Varavoo Kaval and Ullarthi Kaval.



**Fig. 4. Land Use & Land Cover Classification of Khudapura Kaval grassland in 2009 & 2019**



**Fig. 5. Land Use & Land Cover Classification of Varavoo Kaval grassland in 2009 & 2019**



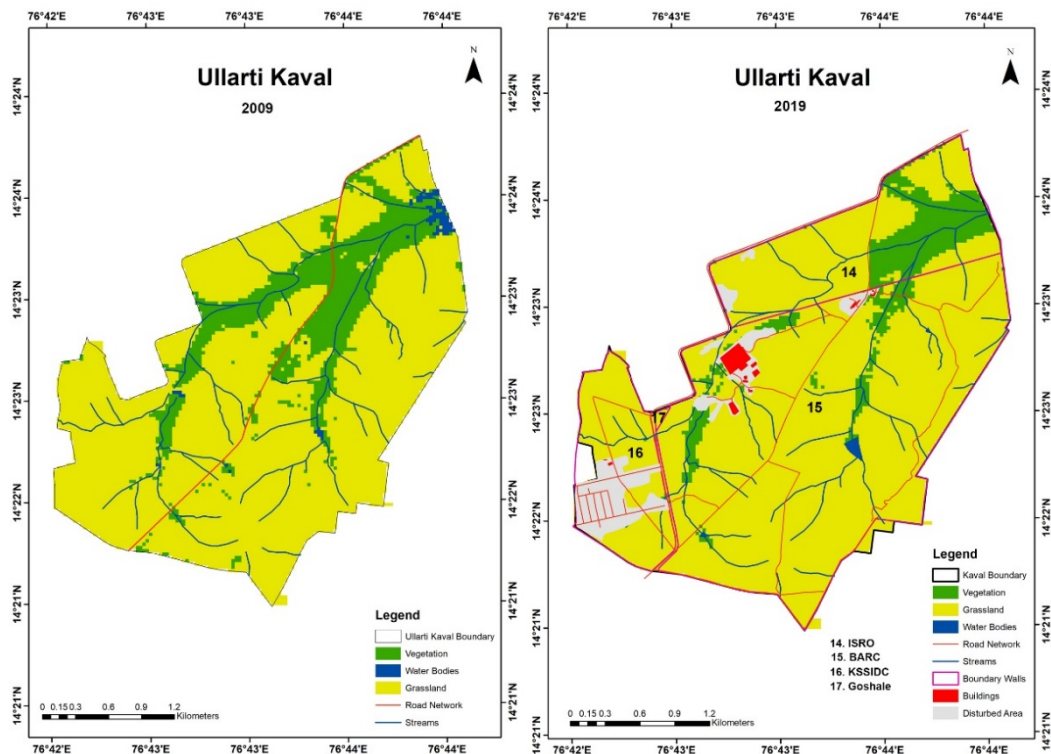


Fig. 6. Land Use & Land Cover Classification of Ullarti Kaval grassland in 2009 & 2019

Table 5. Area coverage of Khudapura Kaval grasslands Land Use & Land Cover Change categories in 2009 & 2019.

Khudapura Kaval							
Sl.No.	Classified	2009		2019		Change	
		Area (Acre)	Area (%)	Area (Acre)	Area (%)	Area (Acre)	Area (%)
1	Vegetation	308.24	10.37	197.08	6.63	-111.16	3.74
2	Water Bodies	8.67	0.29	1.11	0.04	-7.56	0.25
3	Grassland	2647.37	89.12	2322.52	78.17	-324.85	10.95
4	Buildings	0	0	10.82	0.36	10.82	0.36
5	Road Network	6.72	0.22	80.59	2.71	73.87	2.49
6	Boundary Walls	0	0	4.12	0.14	4.12	0.14
7	Disturbed Area	0	0	354.76	11.95	534.76	11.95
Total Area		2971	100	2971	100		

**Table 6. Area coverage of Varavoo Kaval grasslands Land Use & Land Cover Change categories in 2009 & 2019.**

Varavoo Kaval							
Sl.No.	Classified	2009		2019		Changes	
		Area (Acres)	Area (%)	Area (Acres)	Area (%)	Area (Acres)	Area (%)
1	Vegetation	1325.51	14.14	883.7	9.43	-441.81	4.71
2	Water Bodies	50.89	0.54	41.26	0.44	-9.63	0.1
3	Grassland	7981.16	85.18	4736.46	50.54	-3244.7	34.64
4	Solar Area	0	0	1003	10.7	1003	10.7
5	Runway	0	0	348.4	3.72	348.4	3.72
6	Buildings	0	0	12.81	0.13	12.81	0.13
7	Road Network	13.04	0.14	205.39	2.2	192.35	2.06
8	Boundary Walls	0	0	13.66	0.14	13.66	0.14
9	Disturbed Area	0	0	2125.92	22.7	2125.92	22.7
<b>Total Area</b>		<b>9370.6</b>	<b>100</b>	<b>9370.6</b>	<b>100</b>		

**Table 7. Area coverage of Ullarti Kaval grasslands Land Use & Land Cover Change categories in 2009 & 2019.**

Ullarti Kaval							
Sl.No.	Classified	2009		2019		Changes	
		Area (Acre)	Area (%)	Area (Acre)	Area (%)	Area (Acres)	Area (%)
1	Vegetation	383.4	17.6	215.72	9.9	-167.68	7.7
2	Water Bodies	29.84	1.36	4.79	0.21	-25.05	1.15
3	Grassland	1756.41	80.64	1755.33	80.62	1.08	0.02
4	Buildings	0	0	14.13	0.64	14.13	0.64
5	Road Network	8.7	0.4	41.15	1.88	32.45	1.48
6	Boundary Walls	0	0	5.5	0.25	5.5	0.25
7	Disturbed Area	0	0	141.73	6.5	141.73	6.5
<b>Total Area</b>		<b>2178.35</b>	<b>100</b>	<b>2178.35</b>	<b>100</b>		

### 3.1.1 Khudapur Kaval

Having an area of 2971 acres, Khudapur Amrit Mahal Kaval comes between Nayakahatti and Challakere road. In a decade between 2009-2019 one can observe lot of changes in Land-use and Land-cover (Fig. 4).

In 2009, Khudapur Amrit Mahal Kaval grasslands covered an area of 2647.37 acres (89.12%), at present in 2019 it is 2322.52 acres (78.17%). It indicates 10.95% reduction in grasslands. Vegetation reduced from 308.24 acres (10.37%) to 197.08 acres (6.63%) indicating 3.74% reduction. Water Bodies reduced from 8.67 acres (0.29%) to 1.11 acres (0.04%) indicating 0.25% reduction. Currently, in these areas construction of buildings occupy 10.82 acres (0.36%), roads occupy 80.59 acres (2.71%), Boundary walls occupy 4.12 acres (0.14%). With disturbed Area of 354.76 acres (11.95%), natural area has been destroyed. Overall, about 443.57 Acres (14.94%) of the area is under development, destroying the original grassland.

### 3.1.2 Varavoo Kaval

If we consider Varavoo Kaval, it has a geographical area of about 9370 acres and it is the largest grassland area compared of the three Kavals. Varavoo Kaval is near to Neralagunte Village. In 2009, Varavoo Kaval grasslands covered an area of 7981.16 acres (85.18%), at present in 2019, it is 4736.46 acres (50.54%). It indicates 34.64% reduction in grasslands. Vegetation reduced from 1325.51 acres (14.14%) to 883.7 acres (9.43%) indicating 4.71% reduction. Water Bodies reduced from 50.89 acres (0.54%) to 41.26 acres (0.44%) indicating 0.1% reduction in water bodies. Sagitaur Ventures Pvt.Ltd company destroyed grasslands in Varavoo Kaval and built Solar power plant units on an area of 1003 acres (10.7%) [21, 22]. Defense Research and Development Organization (DRDO), a Government of India agency-built runway in 348.4 acres (3.72%) with various proposed buildings and construction in 12.81 acres (0.13%), construction of roads in 205.39 acres (2.2%). The Defense Research and Development Organization (DRDO), Solar Power Plant Unit, National Aerospace Laboratories (NAL) and Upper Bhadra Project has built a compound wall of 54km in about 13.66 acres (0.14%) of the area (Fig. 7a). With a disturbed Area of 2125.92acres (22.7%), natural habitat has been destroyed and development is still in progress (Fig. 8b). About 3696.14 Acres (39.45%) of the area is under development, destroying the original grassland (Fig. 5).

### 3.1.3 Ullarti Kaval

Around 25kms far from Khudapur Amrit Mahal Kaval, near Dodda Ullarti village, 2178 acres of grassland has been sanctioned to Indian Space Research Organization (ISRO), Bhabha Atomic Research Centre (BARC) (Fig. 7b). and Karnataka State Small Industries Development Corporation (KSSIDC). Even here in 2009, grassland covered 1756.41acres (80.64%), at present in 2019, 1755.33 acres (80.62%). It indicates 0.02% reduction in grasslands. Vegetation reduced from 383.4 acres (17.6%) to 215.72 acres (9.9%) indicating 7.7% reduction. Water Bodies reduced from 29.84 acres (1.36%) to 4.79 acres (0.21%) indicating 1.15 % reduction in water bodies. 14.13 acres (0.64%) of land for various buildings, construction of roads in 41.15 acres (1.88%, with disturbed Area of 5.5 acres (0.25%), 141.73 acres (6.5%) of grassland area have been destroyed and development is still in progress. Then overall, about 19381 Acres (8.84%) of the area is under development, destroying the original grassland (Fig. 6).



**Fig. 7a)** The compound wall built in the Challakere Amrit Mahal Kaval grasslands. **b)** Bhabha Atomic Research Centre (BARC) agency encroached the village road.



**Fig. 8a)** People weave blankets in the villages around the Amrit Mahal Kaval grassland for their livelihood. **b)** Natural area has been destroyed and development is in progress.

### 3.2 Consequences on Social, Cultural and Economic factors:

Unscientific development undertaken in the sensitive grassland impacted on Social, cultural and economic rights of people as described below. According to the 2011 census, Challakere Amrit Mahal Kaval has a population of 85,908 out of a total of 43 villages within the five-kilometer buffer zone boundary of Kaval grasslands [23]. Almost all of them here are below the poverty line and belong to the backward classes, whose roots are in farming, dairy and cottage industries.

Challakere area mainly consists of the Amrit Mahal Kaval grassland, and this grassland area absorbs the rainfall as a sponge and increases the water levels of streams, lakes and groundwater level. But this area of grassland is getting destroyed for the construction of buildings, roads and compound walls (Table. 5, 6 & 7) (Fig. 7a). People from 43 villages resorting to water for drinking purposes and also for irrigation purposes for agriculture are facing problems. Cattle, other animals and birds in the grassland are facing the troubles for drinking water.

Uranium Concentration from Baba Atomic Research Center spread over 1822 acres of grasslands in Ullarti and Khudapur Kaval is disposing the waste into ponds and lakes of surrounding area, negatively impact the health of people living in and around due to radiation. There is a fear that the pollution could result in the displacement of people from the communities. Defense Research and Development Organization manufactures armed drones and conducts tests as well. To prevent internal opposition over driverless aircraft, warplanes are manufactured too, which in turn causes trouble to people and biodiversity in the surrounding area. An Unmanned Aerial Vehicle (UAV) crashed during testing and landed over farmers land can be seen in (Fig. 9a & b).





**Fig. 9a)** DRDO's UAV crash-lands in Challakere farmland (Photo courtesy of Times of India). **b)** The drone which crashed near Nayakanahatti in Challakere taluk of Chitradurga district (Photo courtesy of Deccan Herald).

People have been doing poultry farming such as cattle, sheep, goat and buffalo for over hundreds of years. Dairy farming is still their livelihood. We all know Challakere Sheep wool Blanket (Sheep Rug) were famous all over India and were supplied to Indian Soldiers as well. So, the livelihood and economic system of most people depends on sheep grazing. People buy sheep wool in Challakere travelling from distant towns like Davangere and Shimoga. They weave and sell sheep blankets in villages (Fig. 8a). People also sell meat, milk and milk products locally. Importantly, thousands of families depend mainly on the grasslands for livelihood [24].

At present, the walls are restricting the villagers to herd cattle to graze in the grasslands spread over hundreds of acres, forcing them to sell their livestock. There have been instances of migration forcing them to move hundreds of kilometers away. People from the Lambani community, making a living out of weaving baskets, are facing the shortage of Indian Date palm trees and are forced to buy raw materials, travelling to neighboring Andhra Pradesh state. The abundant and fresh medicinal plants growing in grassland were used to solve health issues amongst the people and their cattle. Now, even the medicinal plants are not available.

Indigenous communities have been using and guarding these grasslands around the Kaval for centuries. There are many temples of various tribes and communities of peoples who live around the grasslands. Annual fairs are organized for these temples which marks cultural importance. Clay statue is made from Amrit Mahal Grassland and decorated. Devotion (Bhakti), Sobaane (Pada), Parade (Meravanige) and Fasting (Upavaasa) are conducted displaying bhakti. The Clay idol is immersed in water at the end of the Fair in devotion [25]. With the grasslands destroyed, right to perform such cultural activities is also taken away.

### 3.3 Factors affecting Biodiversity and Environment:

Challakere Amrit Mahal Kaval grassland system is the most extensive and the last remaining micro biological landscape in the state. Most endangered birds like Great Indian Bustard, Lesser Florican. mammals like Black buck, Wolves and Fox are thriving in the grassland and they need extensive grasslands to survive. With the destruction of their habitat, critically endangered creatures are pushed into The IUCN Red List of Threatened Species [24].

In India only 150 individual Great Indian Bustards are surviving. Rajasthan's Jaisalmer has 100, Gujarat's Kutch has 25, Karnataka has 6, Andhra Pradesh has 6 and only 1 in Maharashtra. We need to give the same importance to these critically endangered animals as we give to National Animal of India, the Bengal Tiger. It is miserable to see an endangered birds habitat is used and destroyed for development purposes while the same development can be carried out in un protected and barren lands of lesser environmental importance spread across the Deccan Plateau. Development in Chitradurga's Challakere Amrit Mahal Kaval grasslands had a bad effect on Critically Endangered Great Indian Bustards. These birds are seen only in Karnataka's Ballari, Ranibennur, Challakere, Gujarat, Rajasthan and Andhra Pradesh. The Great Indian Bustard bird needs to be protected under schedule I of Wildlife Protection Act of 1972.

#### **4. CONCLUSION**

Population growth is putting enormous pressure on natural resources of which grasslands are not exempted. Social, cultural, economic and environmental impacts due to the same, puts a doubt about the survival of humans, their livelihood, culture and heritage. Once you look at the statistics of the above three grasslands (Table 5, 6 & 7), the development work here has reduced the area of vegetation by 4.59%, water sources by 0.29% and 24.6% of the grassland is lost.

If common people had done the same kind of damage to these one of a kind, environmentally and culturally important grasslands, reserved and protected for a special breed of cattle of National importance, the law would have brought them to justice, punished them and the land would have been acquired back, but here it's different. Local communities did go from Local Panchyath level to the Hon'ble High Court and the Prestigious Supreme Court but the justice was denied. Sad thing is developmental activities kept continuing even after anti-environmental complaints were lodged at the National Green Tribunal (Southern Zone Bench). On Challakere Amrit Mahal Kaval grassland encroachment issues, an organization named "Environment Support Group (ESG)" is fighting legally with application numbers as 6/2013 and 12/2013 in National Green bench [26]. Various citations can be seen in the context of the submission to the National Green bench, work is being carried out by violating the Environment (Conservation) Act 1986, Environmental Impact Assessment Notification 2006, Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981, Forest Protection Act 1980, Factories Act 1948, The Karnataka Town and Country Planning Act 1961, The Airline Act 1934, The 74th Amendment enacts regulations for the municipal or urban local authority (municipalities). This demonstrates, Justice is different for the masses and the government. Development is very important. But the question is, way should development work be necessarily carried out in ecologically important grasslands, destroying the landscape, uprooting the cultures and forcing the true protectors of the land to move out. Isn't it our responsibility to save the Amrit Mahal Kaval Grasslands for the endangered breed Amrit Mahal and other dependent species which has history of 500 years and all the endangered mammals and birds? Emotional feelings can make it wrong to question the land provided for the defense forces of one's Nation. But it should be overruled knowing the grasslands belongs to the critically endangered Great Indian Bustard [27].

##### **4.1 Suggestions**

- Grasslands doesn't mean work lands It is very important to retain the grasslands by clearing the encroachment and save the Amrit Mahal Kaval Grasslands.

- It is important to protect Amrit Mahal cattle breed which has history of about 500 years and save Amrit Mahal Kaval grasslands reserved for the breed, which is one of its kind in the World.
- Separate law must be created in India for the protection of the grasslands and the endangered flora fauna of the grasslands.

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