



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Determinants of land degradation in Jammu and Kashmir: implications for land governance

S H Baba*, M H Wani, B A Zargar and Ishrat F Bhat

Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir,
Jammu & Kashmir 190025, India

*Corresponding author: drshbaba@skuastkashmir.ac.in

Abstract To arrive at good land governance imperatives, we study land degradation in Jammu & Kashmir. The panel regression estimates indicate that rural literacy and direct institutional credit to farmers reduce land degradation in the state and rural population density and urban population growth increase it. Public investment in agricultural production is critical for land development, irrigation, and forestry, but it has declined recently in absolute and proportionate terms, and poor execution of acts and reforms have brought about deficits in land governance. The study suggests options for making the state's land governance policy efficient and developing its resources.

Keywords Land degradation, land budgeting, determinants, governance, Jammu & Kashmir

JEL classification Q01, Q02, Q15

Land degradation is the diminution in the capability of land, and it is reflected in the reduction of its production potential (Stocking 1995). It is a serious threat to food production and food security worldwide, and more so in regions with uneven terrain and among smallholder farms and landless households (Baba et al. 2014). Several socio-economic, climatic, biological, and geological factors associated with land use are also linked with land degradation. This paper examines the issue of land degradation in the Indian state of Jammu and Kashmir (J&K).

The state has a geographical area of 101,387 sq km and different land forms—plains in the Jammu region and uneven rugged mountainous terrain in the Kashmir valley. Sharma and Arora (2015) report wide-scale land degradation in the Jammu region in the Himalayan foothills. The Kashmir valley is located in the seismotectonic zone, and the actions of rivers and glaciers have rendered it vulnerable to landslides, rockslides, rockfalls, mudslides, debris fans, and other forms of land degradation (Wadia 1979). About 44.4% of the total area of the Kashmir valley is estimated to

suffer from moderate erosion and 48.3% from high erosion (Zaz and Ramshoo 2012). The increasing population pressure and the creation of infrastructure have led to changes in the land use pattern in the state and taken land away from ecologically desirable uses (Wani et al. 2009).

This paper aims to look into the long-term trends in land degradation, changes in land use, and land budget in terms of changes in its use, and identify the factors of land degradation. A deeper understanding of these will help policymakers devise better land governance mechanisms.

Data

This study made use of secondary data obtained from diverse sources. The state-level information on land use pertaining to the period from 1980–81 to 2015–16, and the district-level time-series data on land use for the period 2007–08 to 2016–17, are collected from the Directorate of Economics & Statistics, Government of Jammu & Kashmir. The data on investment (1980–

81 to 2015–16) are compiled from the Directorate of Planning, Department of Economics and Statistics, Government of Jammu & Kashmir. The data on agricultural credit are obtained from the published records of the Reserve Bank of India. The information on other indicators like gross irrigated area, yield of food grains, rural literacy, urban population, etc is obtained from the Digest of Statistics, Government of Jammu & Kashmir. All the monetary variables are deflated at 1980–81 prices.

Analytical procedures

Land budgeting

The dynamics of land use were investigated employing a simple growth accounting technique. Let us write the total reported area as the sum of different land uses as:

$$R_t = Fr_t + P_t + M_t + N_t + B_t + Cw_t + Fc_t + F_t + C_t + O_t \quad \dots(1)$$

where, t is the time, R is the total reported area, Fr is the area under forests, P is the area under permanent pastures, M is the area under miscellaneous tree crops, N is the area under non-agricultural uses, B is the area of barren lands, Cw is the area of culturable wastelands, Fc is the area under current fallows, F is the area of fallow lands other than current fallows, C is net sown area, and O is the other uses including marshy or waterlogged land. Taking the difference in land use between t and $t-1$ yield the following identity, which sums up the changes in area under different land uses.

$$\Delta R = \Delta Fr + \Delta P + \Delta M + \Delta N + \Delta B + \Delta Cw + \Delta Fc + \Delta F + \Delta C + \Delta O \quad \dots(2)$$

We group land use into ecology ($E = Fr + P + M + B$), agriculture ($A = Cw + C + Fc + F$), and non-agriculture (N). The ecological category was further divided into the desirable ($E_1 = Fr + P + M$), and undesirable ($E_2 = B$). Then, we rewrite Equation (2) as:

$$\Delta E = \Delta E_1 + \Delta E_2 = (\Delta Fr + \Delta P + \Delta M) + (\Delta B) \quad \dots(3)$$

$$\Delta A = \Delta Cw + \Delta C + \Delta Fc + \Delta F \quad \dots(4)$$

The land uses in barren land (B), culturable wasteland (Cw), fallow other than current fallow land (F) and others including marshy/waterlogged area (O) were summed to estimate degraded land (DL), and the changes in degraded land were calculated by Equation (5) as:

$$\Delta L = \Delta B + \Delta Cw + \Delta F + \Delta O \quad \dots(5)$$

Determinants of land degradation

To estimate the degraded land, we pool the area of barren lands, culturable wasteland, fallow lands, and marshy or waterlogged land. Barren and culturable wastelands cannot be cultivated—due to their poor fertility, salinity, alkalinity, and water logging—and are defined as degraded. Land may be kept fallow for several years if the water supply is inadequate or farming unremunerative. To identify the determinants of degraded land, we run a balanced panel regression with districts as the units of observation. The Hausman test indicates choosing of the random effects model over the fixed effects (Hausman test statistics = 4.31). The random effects model in log form is specified as:

$$\text{LnDL} = f(\text{LnYCP}, \text{LnRPD}, \text{GIR}, \text{LnCRTd}, \text{UR}, \text{LnRD}, \text{LIT}, \gamma, \lambda_t, U_t) \quad \dots(6)$$

where DL is the degraded land in hectares, $AGDP$ is the agricultural net domestic product in rupees per ha of gross sown area, RPD is the rural population density in persons per ha of reported area, UR is the urban population in percentage, GIR is the gross irrigated area expressed as a percentage of the total sown area, $CRTd$ is the direct credit to agriculture in rupees per ha of gross sown area, YCP is the yield of food grains in metric tonnes per ha, RD is the road density in km per sq km of geographical area, LIT is the rural literacy in %, γ is the cross effect associated with land degradation, λ_t is the time effect specific to a year and U is the error term.

Irrigation is one of the crucial inputs of agricultural production. If farmers are assured that irrigation facilities will be available, it is expected they will feel encouraged to utilize the land productively and that land will not be degraded; therefore, irrigation has been included in the equation. An increase in the rural population density puts pressure on the operational land for residential or commercial uses.

The model includes direct agricultural credit as it enhances the resource position of farmers and encourages them to practise farming and manage productive land scientifically. Better yields improve returns from farming and encourage farmers to utilize productive land and prevent degradation. Education makes people aware of the possible implications of land degradation; therefore, the model includes rural

literacy to ascertain its role in land degradation. We postulate that urbanization takes away productive land from agriculture and that, therefore, its influence on land deterioration is negative. The model has been formulated and estimated in log form to ascertain the influence of specified exogenous variables on land degradation.

Results and discussion

Trends in land use and degraded land

Based on the time that land has not been used, this study categorizes as degraded land fallows other than current fallows (1–5 years), culturable wastelands (> 5 years), barren land, and marshy or waterlogged areas. Culturable wasteland—comprising, mostly, degraded land—cannot be cultivated owing to poor soil fertility, salinity, alkalinity, water logging, etc. Crops cannot

be raised on barren land owing to dryland conditions, poor soil texture, etc. Land kept fallow for several years due to poverty, inadequate water supply, and unremunerative farm business degrades over the years.

Compound growth rates are estimated to observe the trends in different categories of degraded land and other land use classes (Table 1). The land use pattern reveals an increase of 2,000 hectares (ha) in the reported area. About 20% (472,000 ha) of the reported area of the state is degraded; its annual growth rate has been 0.31%. In absolute terms, there has been an addition of 78,000 ha to this category since 1980–81.

Barren land, the major constituent of degraded land, grew consistently at 0.32% per annum. There has been significant growth in all the types of degraded land except culturable wasteland. The trends in the growth estimates of net area sown, land put to non-agricultural

Table 1 Trends in land use and degraded land in J&K from 1980–81 to 2016–17 (000' ha)

Land use	1980–81	1990–91	2000–01	2010–11	2016–17	CGR	SE
Land put to non-agricultural uses (N)	334 (13.8)	291 (12.0)	291 (12.0)	277 (11.5)	252 (10.4)	–0.43*	0.07
Forests (Fr)	658 (27.3)	658 (27.2)	658 (27.2)	658 (27.2)	659 (27.3)	–0.01	0.01
Miscellaneous trees (M)	103 (4.3)	72 (3.0)	72 (3.0)	66 (2.7)	57 (2.3)	–0.96*	0.11
Pastures & grazing (P)	124 (5.1)	127 (5.3)	126 (5.2)	123 (5.1)	119 (4.9)	0.01	0.03
Current fallow (Fc)	94 (3.9)	97 (4.0)	82 (3.4)	101 (4.2)	101 (4.2)	–0.06	0.23
Net sown area (C)	732 (30.3)	731 (30.3)	748 (31.0)	732 (30.3)	757 (31.3)	0.11*	0.02
Degraded land (DL)							
Barren (B)	231 (9.6)	291 (12.0)	289 (12.0)	292 (12.1)	304 (12.6)	0.32*	0.09
Culturable (Cw)	155 (6.4)	137 (5.7)	140 (5.8)	136 (5.6)	139 (5.8)	–0.23*	0.06
Fallow other than current (F)	8 (0.3)	6 (0.2)	8 (0.30)	26 (1.1)	22 (0.9)	3.54*	0.42
Others (O)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.2)	6 (0.3)	42.2*	5.93
Total	394 (16.3)	434 (18.0)	437 (18.1)	463 (19.0)	472 (19.5)	0.27*	0.06
Reported area (R)	2,414	2,416	2,416	2,416	2,417	0.001*	0.00

Note CGR = Compound growth rates (%). SE = Standard error

Figures in parentheses indicate percentage of reported area

*Denotes significance at 0.05 or better probability level

uses, and culturable wastelands are desirable, but the decline of the area under miscellaneous trees is expected to aggravate the problems associated with land degradation, and the increase in the area under current fallows needs the immediate attention of revenue officials and planners.

Land use pattern and extent of land degradation across districts

Over 74% of the total reported area of 2.4 million hectares in Jammu & Kashmir falls in Jammu, and only 23% in Kashmir and 2.7% in Ladakh (Table 2). Baramulla is the biggest district in Kashmir in terms of reported area; Udampur, Kathua, Rajouri, and

Jammu districts occupy the major reported area in Jammu Division. The state's forests are almost entirely in Jammu; a meagre 5,200 ha is in Kashmir. Jammu province occupies about 400,000 ha of net sown area, which is 93 ha more than in Kashmir. Ladakh occupies only 2.6% of the state's net sown area, and that area is distributed equally between its two districts.

About 75% of the state's degraded land is in Jammu, 18% in Kashmir, and 7% in Ladakh. Degradation in Jammu is due apparently to its endowment of barren and culturable wasteland; in Kashmir, marshy or waterlogged land and fallows other than current fallows were the major constituents of degraded land; and in Ladakh, land degradation owed exclusively to barren

Table 2 Land use pattern and degraded land across districts in J&K in 2016–17 (%)

District	R	N	Fr	M	P	Fc	C	B	Cw	F	O	DL
Anantnag	3.0	1.1	0.0	3.7	5.9	1.2	6.2	2.0	2.2	0.0	52.0	2.6
Kulgam	2.0	1.6	0.0	1.5	1.9	6.4	3.9	0.6	1.7	2.3	0.0	1.0
Srinagar	0.5	0.4	0.1	0.0	0.1	1.5	0.8	0.2	0.0	4.1	13.4	0.5
Ganderbal	1.6	1.2	0.2	2.3	1.5	7.1	2.0	0.6	1.8	24.4	2.5	2.1
Baramulla	4.5	7.9	0.2	0.6	3.3	1.8	8.5	1.8	8.5	1.1	0.1	3.7
Bandipora	1.4	0.5	0.1	0.1	2.4	0.5	3.2	1.5	0.5	0.0	1.1	1.1
Pulwama	2.5	3.3	0.0	1.9	5.0	4.1	4.6	0.8	2.6	0.8	0.0	1.3
Shopian	1.5	1.6	0.0	0.6	2.5	10.7	1.9	0.6	1.3	1.2	0.0	0.8
Budgam	3.2	1.8	0.1	1.7	4.6	13.0	5.5	1.2	3.0	9.1	22.8	2.4
Kupwara	2.8	1.4	0.0	0.4	1.6	2.6	6.0	1.9	2.6	11.9	0.0	2.6
Kashmir province	23.0	20.8	0.8	12.9	28.7	48.9	42.5	11.1	24.2	54.9	91.8	18.1
Leh	1.9	2.9	0.0	3.1	0.1	0.1	1.3	7.7	1.2	0.2	0.0	5.4
Kargil	0.8	0.2	0.0	0.4	0.0	1.3	1.3	1.4	1.5	4.7	0.0	1.5
Ladakh province	2.7	3.1	0.0	3.5	0.1	1.4	2.6	9.1	2.7	4.9	0.0	6.9
Jammu	9.8	13.8	4.5	3.4	8.4	3.5	14.1	11.3	11.3	3.0	1.6	10.8
Samba	3.4	3.1	1.6	1.8	0.8	1.3	4.3	6.1	7.5	0.4	0.0	6.1
Udampur	11.6	9.0	18.9	5.9	5.5	6.6	6.5	14.4	16.4	0.7	2.9	14.2
Resai	6.3	2.2	10.3	13.5	8.1	13.1	2.8	7.0	3.7	1.5	0.0	5.7
Doda	7.8	5.4	15.2	9.5	1.8	11.9	3.9	5.0	6.0	3.5	3.7	5.2
Kishtwar	4.5	2.5	8.9	11.7	3.2	0.3	2.1	4.2	3.5	0.6	0.0	3.8
Ramban	4.7	5.1	9.2	4.1	2.8	0.9	2.6	3.6	2.0	0.1	0.0	2.9
Kathua	10.9	18.3	10.9	31.9	7.9	11.5	7.8	10.7	6.4	29.9	0.0	10.2
Rajouri	10.5	13.0	14.4	1.8	17.1	0.4	7.1	11.7	10.6	0.0	0.0	10.7
Poonch	4.8	3.5	5.2	0.0	15.6	0.3	3.6	5.9	5.6	0.4	0.0	5.5
Jammu province	74.3	76.0	99.1	83.6	71.1	49.7	54.8	79.8	73.1	40.2	8.2	75.0
State	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	(2,417)	(252)	(659)	(57)	(119)	(101)	(757)	(304)	(139)	(22)	(6)	(472)

Note: R = Reported area, N = Land put to non-agricultural uses, Fr = Forests, M = Miscellaneous trees, P = Permanent pastures & grazing land, Fc = Current fallows, C = Net sown area, B = Barren, Cw = Culturable wasteland, F = Fallow land other than current fallow, O = Others including marshy/waterlogged, DL = Degraded land, and Figures within parentheses absolute area in 000' ha.

and fallow land. Province-specific strategic measures are needed to reclaim culturable and fallow land.

Changes in land budget

We work out the net sectoral rate of change in land use under different land uses and ecological classes to see the changes in degraded land and to find out which land classes in the state's districts were degraded between 2007–08 and 2016–17. The budgeting results show that degraded land in the state increased by 2,500 ha since 2007–08. There has been a desired decline in fallows other than current fallows, culturable wastelands, and other land uses, and the drastic increase in barren land led the net degraded land in the state to increase. There was a favourable decline of about 41,000 ha in land put to non-agricultural uses, and a desired shift of 23,000 ha to net sown area, but most of the land released from the non-agricultural sector is not being cultivated. The decline of 19,000 ha from desirable ecological sectors, especially from permanent pastures and miscellaneous trees, may cause serious environmental problems; it needs the immediate attention of planners.

An increase of 35,000 ha in current fallows is expected to deteriorate the quality of land for cultivation and would exacerbate degradation problems. The land degradation pattern and shifts of land between different classes in Jammu province is similar, but inter-district variations are huge. The degraded land area in Udhampur district has increased about 37,000 ha, and land use has shifted from non-agricultural uses and desirable ecological classes to barren and cultural wasteland. There has been a favourable decrease in the degraded land area in Jammu; part of this reclaimed land has been brought under cultivation and the other part shifted to non-agricultural uses. The decline in land under undesirable ecology (E_2), which broadly comprises barren land in Jammu, is a scenario worth emulating for other districts of the state.

The degraded land area in Kashmir province has increased over 6,000 ha (3,100 ha in barren and 3,400 ha in culturable wasteland). This land has come from pastures, miscellaneous trees, and forest land uses of desirable ecology (E_1). The area under current fallows has also increased. The scenario of land degradation and shifts in land use in Baramulla, Budgam, and Kupwara districts seem more unfavourable. Anantnag is the only district in Kashmir

province where a decline in land degradation is associated with an increase in the area under cultivation and desirable ecology class and with a decrease in the area under land put to non-agricultural uses.

The decline in degraded land in the Leh district of Ladakh province is a desired feature of land use shift, though the decline in the area under cultivation and desirable ecological class is a cause of concern. The crisis arising due to the shift of land to unproductive uses and its degradation in the long run is made more severe by the increasing fragmentation of holdings. The number of landholdings has been increasing at an alarming rate; in 2015–16, the landholding size averaged just 0.40 hectares (Baba 2018).

Determinants of land degradation

The model was estimated under two assumptions: with no cross effect (district) or time effect ($\gamma_{ij}=0$, $\lambda_t = 0$); and with both cross and time effects ($\gamma \neq 0$, $\lambda_t \neq 0$). The comparison of both cases for relevant parameters indicated that the model with both cross and time effects was the best fit. The explanatory variables included in the model explained 63% of the total variation in the dependent variable, i.e., degraded land (Table 3).

As expected, the regression coefficients corresponding to rural population density and urbanization were found to be positive and significant determinants of land degradation across the state's districts. The coefficient for gross irrigated area indicated that intensive use of the irrigated area helps reduce land degradation. Greater irrigation intensity improves the return per unit of land and encourages farmers to continue farming and practise it as scientifically recommended.

Direct institutional credit to the agricultural sector has the desired influence on the land. It helps reduce degraded land, improves agricultural growth directly and indirectly, and encourages private investment in agriculture and land development (Baba et al. 2012). This is an important finding of this study, and there is a need to enhance direct institutional credit to the agricultural sector. The coefficient of rural literacy is a significant factor in helping reduce unproductive land use in the state (Table 4).

Implications for land governance

The Government of Jammu and Kashmir has been enacting legislation and initiating schemes to develop

Table 3 Estimates of land use budgeting in Jammu & Kashmir from 2007–08 to 2016–17 (000' ha)

District	ΔR	ΔN	ΔF	ΔM	ΔP	ΔFc	ΔC	ΔB	ΔCw	ΔF	ΔO	ΔE ₁	ΔE ₂	ΔA	ΔDL
Anantnag	0.0	-5.4	0.0	1.0	3.6	1.1	0.1	0.8	0.5	-0.1	-1.4	4.5	0.8	1.6	-0.2
Kulgam	0.0	-1.4	0.0	-0.4	-1.5	6.4	-1.5	-1.8	-0.4	0.4	0.0	-1.8	-1.8	5.0	-1.8
Srinagar	0.0	-1.2	0.0	-0.4	-0.5	0.6	1.6	0.0	-0.7	0.7	-0.2	-0.9	0.0	2.3	-0.1
Ganderbal	0.0	-2.8	0.0	0.5	0.1	0.1	0.8	-2.0	1.3	1.8	0.2	0.6	-2.0	4.0	1.2
Baramulla	-0.2	8.8	0.0	-0.9	-4.6	-4.1	-0.4	-1.3	3.6	-1.4	0.0	-5.4	-1.3	-2.3	1.0
Bandipora	0.1	-2.3	0.0	-0.3	0.2	-1.4	3.9	2.3	-1.9	-0.5	0.1	-0.1	2.3	0.1	0.0
Pulwama	0.1	0.9	-0.1	0.0	-0.5	-1.8	2.4	-0.1	-0.1	-0.6	0.0	-0.5	-0.1	-0.2	-0.8
Shopian	-0.3	-0.6	0.0	-0.3	-0.9	7.3	-5.3	0.2	-0.4	-0.2	0.0	-1.2	0.2	1.3	-0.5
Budgam	0.0	-3.6	0.0	-0.2	-2.3	4.1	-0.9	2.5	0.4	-0.5	0.4	-2.5	2.5	3.1	2.8
Kupwara	0.0	-1.6	0.0	0.0	-3.2	0.2	-0.1	2.5	1.1	1.0	0.0	-3.2	2.5	2.2	4.6
Kashmir province	-0.3	-9.0	-0.1	-0.8	-9.6	12.4	0.7	3.1	3.4	0.5	-1.0	-10.5	3.1	17.1	6.1
Leh	0.5	4.5	0.0	0.6	-0.9	0.0	-0.2	-1.7	-2.7	-0.1	0.0	-0.3	-1.7	-3.0	-4.5
Kargil	0.0	-0.5	0.0	-0.2	0.0	1.3	0.3	-0.4	-1.0	0.9	0.0	-0.1	-0.4	1.5	-0.5
Ladakh province	0.5	4.0	0.0	0.4	-0.9	1.3	0.0	-2.1	-3.7	0.8	0.0	-0.5	-2.1	-1.5	-5.0
Jammu	0.8	12.2	0.1	-0.2	-3.1	1.7	25.6	-18.2	-14.6	-2.9	0.1	-3.2	-18.2	9.9	-35.5
Samba	0.0	0.0	-0.1	0.3	-3.6	0.7	4.2	0.0	-0.3	-1.2	0.0	-3.5	0.0	3.5	-1.4
Udhampur	0.0	-29.1	0.0	-8.9	-0.2	1.1	0.4	25.2	11.6	-0.3	0.2	-9.1	25.2	12.8	36.8
Resai	0.2	-22.6	0.5	1.0	6.1	10.2	-5.4	11.3	-0.9	0.1	0.0	7.6	11.3	4.0	10.5
Doda	-0.2	1.6	-0.1	-6.2	-0.9	11.1	-0.3	-4.0	-1.9	0.2	0.2	-7.2	-4.0	9.2	-5.5
Kishtwar	0.3	-0.9	0.5	-0.1	2.0	-0.2	-1.5	1.8	-1.0	-0.2	0.0	2.4	1.8	-3.0	0.5
Ramban	0.0	5.6	0.0	-0.1	1.5	-5.0	1.7	-0.7	0.7	-3.8	0.0	1.4	-0.7	-6.3	-3.8
Kathua	-0.1	0.0	-0.1	4.8	-1.5	1.6	-2.2	-1.6	-4.2	3.2	0.0	3.2	-1.6	-1.7	-2.6
Rajouri	0.0	-0.6	0.5	0.3	0.0	-0.1	0.0	-2.7	2.8	-0.2	0.0	0.8	-2.7	2.5	-0.1
Poonch	0.6	-1.9	0.0	0.0	0.5	-0.2	-0.2	2.0	0.5	-0.1	0.0	0.5	2.0	0.0	2.4
Jammu province	1.7	-35.7	1.2	-9.1	0.8	20.9	22.3	13.2	-7.3	-5.1	0.5	-7.0	13.2	30.8	1.3
State	1.9	-40.8	1.2	-9.5	-9.7	34.7	23.0	14.2	-7.6	-3.7	-0.5	-18.0	14.2	46.4	2.5

Note: R = Reported area, N = Land put to non-agricultural uses, Fr = Forests, M = Miscellaneous trees, P = Permanent pastures & grazing land, Fc = Current fallows, C = Net sown area, B = Barren, Cw = Culturable wasteland, F = Fallow land other than current fallow, O = Others including marshy/waterlogged, E1 = Desirable ecology, E2 = Undesirable ecology, A = Agricultural ecology and DL = Degraded land.

land resources; however, execution has been ineffective.

Investment in agriculture and land development

Public investment is crucial in reclaiming problematic soils and preserving and upgrading land for productive uses. The state government has invested heavily in agricultural production, including land development; irrigation (major, medium, and minor); and forestry, including soil and water conservation and integrated watershed development. Table 4 presents the investment deflated at 1980–81 prices.

During 1980–81, most of the investment in agriculture was made in agricultural production, including land development, followed by irrigation. Public investment in agriculture increased steadily from about INR 347.5 million (1980–81) to INR 1003.9 million (2010–11), but it has declined recently because emphasis has shifted to other economic sectors like defence, administrative services, health, and social welfare. Agricultural investment (in irrigation, forests, and soil and water conservation) constituted about 21% of total state investment during 1980–81, but it fell to just 5% in 2015–16. This decline is a cause for concern, because

Table 4 Regression estimates of panel-model of degraded land (2007–08 to 2015–16)

Explanatory variables	With cross & time effect ($\gamma \neq 0, \lambda t \neq 0$)		Without cross & time effect ($\gamma = 0, \lambda t = 0$)	
	Coefficient	P> z	Coefficient	P> z
Intercept	-0.727	0.050	-0.502	0.110
RPD	0.372*	0.022	0.229*	0.035
YPC	-0.196	0.059	-0.021	0.084
GIR	-0.096*	0.024	-0.066*	0.021
CRTd	-0.299*	0.001	-0.202*	0.010
UR	0.122*	0.021	0.083*	0.021
RD	0.262	0.054	0.152	0.142
LIT	-0.103*	0.002	-0.055	0.055
R ²	0.6318		0.4372	
DF	212		212	
Wald's chi square	89.31		67.21	
Probability chi square	0.002		0.001	

Note: * represent significance at 0.05 probability level

Table 5 Public investment in the state at 1980–81 prices (INR in lakhs)

Year	Agriculture						Non-Agriculture			TIS
	AG	FR	MMI	MI	CAD	Total	FC	NAG	Total	
1980–81	1,456 (8.60)	264 (1.56)	865 (5.11)	768 (4.54)	123 (0.73)	3,475 (20.54)	628 (3.71)	12,816 (75.75)	13,443 (79.46)	16,918 (100.00)
1990–91	2,959 (9.81)	909 (3.01)	730 (2.42)	768 (2.54)	80 (0.26)	5,445 (18.05)	348 (1.15)	24,378 (80.80)	24,726 (81.95)	30,171 (100.00)
2000–01	3,279 (6.65)	2,601 (5.28)	1930 (3.92)	1,363 (2.77)	159 (0.32)	9,331 (18.94)	769 (1.56)	39,171 (79.50)	39,940 (81.06)	49,271 (100.00)
2010–11	3,772 (3.18)	784 (0.66)	1,550 (1.31)	3,563 (3.01)	370 (0.31)	10,039 (8.47)	1908 (1.61)	106,563 (89.92)	108,470 (91.53)	118,509 (100.00)
2015–16	5,770 (3.18)	674 (0.37)	412 (0.23)	1,715 (0.95)	753 (0.42)	9,324 (5.14)	1,889 (1.04)	170,236 (93.82)	172,125 (94.86)	181,449 (100.00)

Note: Figures within parentheses indicate percentage of total investment; AG= Agricultural production, FR = Forestry, MMI = Major & medium irrigation, MI = Minor irrigation, FC = Flood control, NAG = Non-agricultural sector excluding flood control and TIS = Total public investment in the state.

its implications on agricultural productivity and land degradation are severe. The increase in investment in command area development and flood control, especially after the 2014 floods in the state, is appreciable, but the decline in agricultural investment in absolute and proportionate terms needs the attention of policymakers.

Public investment in agricultural production including land development grew at 2.4% per annum since 1980–81 (Table 5), but growth fell in the later periods after

increasing at 3.4% in the first period. There was a similarly drastic deceleration in investment in the second period in forestry (including soil and water conservation and integrated watershed development); during the first period, investment had grown at 10.11% per annum. The investment trend in major and medium irrigation has also been discouraging; after a declining trend in the first period, investment in minor irrigation, command area development, and flood control increased significantly during the second period. A good proportion of investment in agriculture goes into

Table 6 Growth and intensity of public investment at 1980–81 prices

Year	AG	FR	MMI	MI	CAD	FC	NAE	TIS
Compound growth rate (%)								
Period-I (1980–98)	3.44* (0.84)	10.19* (0.87)	–2.40* (0.50)	0.48 (0.39)	–0.27 (0.78)	–0.53 (1.08)	7.12* (0.37)	6.22* (0.34)
Period-II (1998–2016)	0.34 (1.45)	–11.51* (2.27)	–2.91 (2.18)	3.26 (2.94)	11.24* (1.43)	9.30* (1.46)	7.91* (0.70)	7.02* (0.68)
All (1980–2016)	2.40* (0.43)	1.34 (1.12)	0.96 (0.65)	3.11* (0.74)	6.23* (0.64)	4.50* (0.61)	6.96* (0.20)	6.36* (0.19)
Investment Intensity (% of NDP)								
1980–81	2.95	0.54	1.75	1.56	0.25	1.13	23.06	16.12
1990–91	5.13	1.58	1.27	1.33	0.14	0.42	29.44	21.48
2000–01	5.55	4.41	3.27	2.31	0.27	0.99	50.54	36.09
2010–11	4.17	0.87	1.71	3.94	0.41	1.28	71.74	49.58
2015–16	4.37	0.51	0.31	1.30	0.57	0.70	63.13	45.17

Note: Figures in parentheses indicate standard error, * Denotes significance at 0.05 or better probability levels; AG= Agricultural & allied sectors including land development, FR = Forest including soil/water conservation & integrated watershed development, MMI = Major & medium irrigation, MI = Minor irrigation, FC = Flood control, NAG = Non-agricultural sector excluding flood control and TIS = Total public investment in the state.

irrigation, but it has not resulted in a proportionate expansion in irrigation capacity (Table 6).

The investment intensity is investment expressed as a percentage of the state net domestic product (NDP) generated in the respective sector. The investment intensity of all the items of agricultural investment, except for investment in command area development, increased to 15% of the agricultural NDP in 2000–10; later, however, towards 2015–16, it fell significantly. The agricultural investment intensity is much less than the non-agricultural investment intensity. The declining trends of investment in agricultural production and forestry might negatively impact land development and, in turn, food availability. Therefore, there is a need to double the intensity of agricultural investment,

especially in forestry, soil and water conservation, and irrigation.

Direct institutional credit to agriculture

Direct institutional credit to agriculture negatively influences land degradation. The direct credit to the agricultural sector in J&K constituted about 12% of the total credit outstanding during 1980–81. After increasing steadily up to 2000–01, and after the banking reforms of 2004, a spurt was witnessed in direct credit outstanding to agriculture, and it increased manifold towards 2015–16 (Table 7). The share of direct agricultural credit in total credit outstanding increased from 5% in 2000–01 to 17% in 2015–16, but in proportionate terms it was much less than non-

Table 7 Credit outstanding to agricultural sector in the state

Year	Ag. credit Direct/ha	Ag. credit Indirect/ha	Ag. credit Direct % of total credit	C-Dratio
1980–81	116	14	12	0.03
1990–91	184	43	10	0.49
2000–01	363	15	5	0.38
2010–11	2,059	351	8	0.37
2015–16	7,956	317	17	0.44
Absolute Δ	7,840	303	5	0.41

agricultural credit (Baba 2018). The credit advanced to farmers in the state's provinces constitutes only a meagre proportion of its total estimated credit requirement (Baba et al. 2012), and the number of rural bank branches has declined since 2000–01 (Baba 2018).

Stagnant productivity of foodgrain crops and extension deficits

The yield levels of important crops are to be improved, in view of their desired association with land degradation, but the seed replacement rate in the state is low (DES 2017), due to extension deficits and possibly to the short supply of certified seeds. The low seed replacement rate led the productivity of rice and maize to stagnate (Baba et al. 2012, 2014). Research and development (R&D) institutions and development departments need to develop a seed plan and replace obsolete technology or land races at the field level. Above all, they need to bridge the wide extension deficits, enable the prompt delivery of services, and encourage farming on scientific lines.

Fixing land rates and protection of title

Farmers abandon farming and keep land fallow for a number of years to make it available for urban demands. The sale and resale of land before its final ownership deteriorates its capabilities to support crops. The Government of Jammu & Kashmir has fixed rates for

different land categories to protect titles, impose controls on the land market, and make land transactions accountable- (Table 8). The commercial category of land was given the most value, followed by residential and crop land, in consideration of the availability of irrigation, markets, and road connectivity. Fixing rates and imposing stamp duties have helped generate significant revenue and restrict the frequency of sales, but it has failed to protect land titles. The land is not being utilized as per its title; residential settlements are coming up on prime irrigated land. Aiming to retain land for farming, the government eliminated the stamp duty on land transfer for women in 2016–2017; land ownership for women went up, but the desired intention was not fulfilled. Land is categorized by valuation; this has enabled the conversion of farmland in the land use class of fallows other than current fallows. Land rates increased drastically between 2010–11 and 2018–19 and, therefore, the costs involved in the change of land ownership rose too, but conversion of productive land is rampant in the state.

Lags in digitization of land records

The Digital India Land Records Modernization Programme aims to modernize and manage land category records, prevent land-related disputes, and facilitate land ownership. The Government of India launched it in August 2008, but in Jammu & Kashmir the Land Records Management Agency delayed its

Table 8 Fixing land rates in Kashmir province of J&K (INR/kanal)

Kashmir			Residential		Commercial		Agriculture		Horticulture	
			Min	Max	Min	Max	Min	Max	Min	Max
Central	2018–19	Urban	13.6	88.8	19.2	143.8	7.9	33.4	3.3	10.3
		Rural	9.0	17.1	11.6	22.0	5.9	12.1	2.4	4.0
	2010–11	Urban	8.2	45.5	11.1	95.2	4.7	20.7	1.7	6.5
		Rural	4.3	8.5	6.6	11.2	3.3	6.8	1.1	1.8
North	2018–19	Urban	2.3	28.2	2.7	23.1	1.7	9.2	1.5	8.9
		Rural	1.8	6.4	1.5	7.0	1.3	4.8	1.4	4.9
	2010–11	Urban	1.5	12.6	1.2	12.0	0.9	4.5	0.8	5.2
		Rural	1.0	3.2	0.8	3.2	0.8	2.6	0.6	2.5
South	2018–19	Urban	5.8	30.9	6.4	40.6	3.7	17.4	4.3	15.7
		Rural	4.6	16.3	8.3	21.7	3.3	10.8	4.0	11.9
	2010–11	Urban	2.5	17.2	3.7	21.3	2.0	10.1	2.1	9.1
		Rural	2.0	7.9	4.6	10.2	1.6	4.9	1.9	5.8

Note Land category under agriculture and horticulture include irrigated + un-irrigated/with and without roads

launch by over six years. The first phase of land records digitization was to be completed by February 2018, but it had not been completed even at the end of the first fortnight of July 2019, and this delay will affect the schedule of the other phases. Logistics along with competent manpower are to be put in place or outsourcing would help expedite the digitization process.

Failure of misconceived Roshni Act

The Jammu and Kashmir State Lands (Vesting of Ownership to the Occupants) Act, 2001 (Roshni Act) aimed to transfer ownership rights of state land to occupants on payment and benefit farmers tilling the land for decades. Instead, it led to encroachment in cultivated areas and illegal ownership, and only 24% of the estimated amount was raised between 2007 and March 2013 in the actual transfer.

Conclusions and policy suggestions

An attempt was made in this paper to examine the extent and determinants of land degradation in Jammu & Kashmir and discuss the land use pattern and governance issues. About 470,000 hectares of land was degraded, and the area of degraded land has increased drastically over the years. Most of the degraded land is in Jammu province; only 18% is in Kashmir and 7% in Ladakh. The endowments of degraded land vary widely by district. Inter-sectoral budgeting shows that 2,500 ha of land was degraded between 2007–08 and 2016–17. Kashmir province has experienced an increase of over 6,000 ha in degraded land; it has come from pastures, miscellaneous trees, and forest land uses of desirable ecology. In absolute terms, land degradation seems to be relatively more unfavourable in a few districts: degraded land increased in Udhampur district of Jammu province by 37,000 ha since 2007–08, and land under non-agricultural uses and desirable ecological classes was shifted to barren and cultural wasteland. Jammu district, however, has experienced a favourable decline in degraded land.

The estimates of regression models help us identify the variables of land degradation in the state. Land development plays an important role, but there has been a drastic decline in absolute public investment in agricultural production, including land development, irrigation, and forestry. The government has been proactive in land development, but this study highlights

several issues and suggests policy options for improving the management and governance of land resources.

Expanding irrigation capacity would improve the intensive use of land. Location-specific technological advancements are needed to harness the potential use of water resources through low-gestation irrigation projects. Existing irrigation structures should be made functional to improve the efficiency of the existing capital stock.

Investment in agricultural production, land development, and irrigation should be deepened to restore degraded land and positively influence agricultural productivity. Regional, niche-based specialization would enhance income, protect against risks, enhance soil properties, and prevent land degradation.

Improving the proportion and intensity of direct agriculture credit would encourage the farming community to make productive uses of land and adopt technology. The credit policies should favour all the regions equitably. The branches of rural banks, especially of Regional Rural Banks, need to be expanded to improve their reach to the farming community.

A rigid designation of basic agricultural land and a one-size-fits-all farmland preservation policy may result in runaway urban development, chaotic land use patterns, and inefficient use of land resources (Lichtenberg and Ding 2008). In light of the existing state of technologies, limited land resources, and environmental concerns, the build-up under modernization needs to be balanced by policy support.

Good governance is crucial in controlling land markets, utilizing land as per the title, and preventing the loss of agricultural land to aspects of the brown economy. It is necessary to develop a more reliable database that uses remote sensing techniques, the Global Positioning System (GPS), geographical information systems (GIS), and digitized land records; and this need calls for a more rigorous, region-specific analysis of cultivable wastes and other fallows. Rural livelihoods will benefit if tenancy laws are revisited, further fragmentation of landholdings is prevented, and a suitable institutional mechanism is developed for the scientific management, conservation, and development of pastures and land resources.

There is a need to make use of modern science and technology to sustainably enhance the productivity of existing land resources on basis. To reduce the magnitude of land degradation, measures such as soil and water conservation, integrated watershed development, and land reforms should be taken up rigorously. Adopting appropriate planning and management practices of land use would help minimize the degradation in soil physical quality and ensure sustainable crop production and productivity. There is little scope for expanding the area under cultivation; therefore, it is necessary to enhance agricultural productivity to achieve food security and encourage the productive utilization of land. To achieve this, the extension network has to be streamlined. The Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir has developed a seed plan for rice that has paid off handsomely (Baba et al. 2018), and endeavours are being made to replicate these road maps for other crops grown in the state.

Acknowledgement

This paper is based on the data collected under 'S&T interventions in agricultural & allied sector for strengthening livelihood security in Kashmir-J&K', a research project sponsored by the Department of Science & Technology (DST), Ministry of Science & Technology, Government of India New Delhi. The authors gratefully acknowledge the financial assistance provided by the DST for conducting this study.

References

- Baba, S H and M H Wani. 2012. *Transformation of rural economy in Jammu & Kashmir*. Final Technical Report of Indian Council of Social Science Research (ICSSR) sponsored research project, Division of Agricultural Economics & Marketing, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar Campus, Srinagar, Jammu & Kashmir.
- Baba, S H, G Ali, and M H Wani. 2018. Technological interventions in rice to double farmers' income in Kashmir valley. *Policy Research Series/SKUAST-K/2018/01*. Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar Campus, Srinagar, Jammu & Kashmir.
- Baba, S H, M H Wani, B A Zargar, and H A Malik. 2014. Imperatives for sustenance of agricultural economy in the mountains: A prototype from Jammu & Kashmir. *Agricultural Economics Research Review* 27 (2): 243–57. doi:10.5958/0974–0279.2014.00028.7
- Baba, S H. 2018. *S&T intervention in agricultural and allied sector for strengthening livelihood security*. Final Technical Report of Department of Sciences and Technology (DST) sponsored research project, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar Campus, Srinagar, Jammu & Kashmir.
- Baba, S H, M H Wani, and B A Zargar. 2012. *Study of rural credit and its impact on agricultural growth and sustainable livelihood in Jammu & Kashmir*. Final Technical Report # 02, Division of Agricultural Economics & Marketing, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar Campus, Srinagar, Jammu & Kashmir.
- Baba, S H, M H Wani, and B A Zargar. 2011. Dynamics and sustainability of livestock sector in Jammu & Kashmir. *Agricultural Economics Research Review* 24: 119–32. core.ac.uk/download/pdf/6426042.pdf
- Directorate of Economics & Statistics (DES), Government of Jammu & Kashmir. 2017. *Economic survey 2017*. ecostatjk.nic.in/Economic%20Survey%202017.pdf
- Directorate of Economics & Statistics (DES), Government of Jammu & Kashmir. *Digest of statistics*, various issues. ecostatjk.nic.in/publications/publications.htm
- Hausman, J A. 1978. Specification tests in econometrics. *Econometrica* 46 (6): 1251–271. doi:10.2307/1913827
- Lichtenberg, E and C Ding. 2008. Assessing farmland protection policy in China. *Land Use Policy* 25 (1): 59–68. doi:10.1016/j.landusepol.2006.01.005
- Reserve Bank of India. nd. *Statistical tables relating to banks in India, various issues*. <https://www.rbi.org.in/Scripts/AnnualPublications.aspx?head=Statistical%20Table%20Relating%20to%20Banks%20in%20India>
- Stocking, M A. 1995. Soil erosion in developing countries: where geomorphology fears to tread! *Catena* 25 (1–4): 253–67. doi.org/10.1016/0341-8162(95)00013-I
- Wadia, D N. 1979. *Geology of India*. 4th ed. Tata McGraw-Hill, New Delhi.
- Wani, M H, S H Baba, and S Yousuf. 2009. Land-use dynamics in Jammu and Kashmir. *Agricultural Economics Research Review* 22 (January-June): 145–54. core.ac.uk/download/pdf/6689657.pdf
- Zaz, S N and S A Romshoo. 2012. Assessing the geo-indicators of land degradation in the Kashmir Himalayan region, India. *Natural Hazards* 64: 1219–245. doi:10.1007/s11069–012–0293–3

