



**International Journal of Humanities & Social Science Studies (IJHSSS)**

A Peer-Reviewed Bi-monthly Bi-lingual Research Journal

ISSN: 2349-6959 (Online), ISSN: 2349-6711 (Print)

Impact Factor: 6.8

Volume-XI, Issue-VI, November 2025, Page No. 141-155

Published by Scholar Publications, Sribhumi, Assam, India, 788711

Website: <http://www.ijhsss.com>

DOI: [10.29032/ijhsss.vol.11.issue.06W.167](https://doi.org/10.29032/ijhsss.vol.11.issue.06W.167)



## **Sustainable Development and Climate Change Adaptation through Santal Indigenous Knowledge Systems (IKS) and Traditional Practices**

**Asim Kisku**

*Research Scholar, Dept. of Geography, Visva-Bharati, Santiniketan, West Bengal, India*

Received: 18.10.2025; Accepted: 07.11.2025; Available online: 30.11.2025

©2025 The Author(s). Published by Scholar Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>)

### **Abstract**

*This paper explores the role of the Santal Indigenous Knowledge Systems (IKS) and traditional practices in promoting sustainable development and climate change adaptation. The Santals are third of largest in number among the Indigenous communities who live mainly in the states of Jharkhand, West Bengal, Bihar, Odisha and Assam in India. They also live in neighbouring countries like Bangladesh and Nepal (known as Satar in Nepal) etc. This community are coming from Munda linguistic group and they are speaking the Santali language. Its language is under the Munda language group. Everywhere they introduce themselves as 'Hor' which means 'man'. In the opinion of Suniti Kumar Chatterjee, the linguist, the word 'Santal' probably originated from Sanskrit word 'Samantapal' or the border Security. In the Mediaeval ages this 'Samantapal' broke into 'Samanta - Al' and later 'Sawantal' and ultimately became 'Santal'. According to Santals heritage, they originated from the 'Kherwar' stream. Santals also introduce themselves as 'Kherwal'. The Santals possess traditional ecological knowledge that contributes to environmental sustainability, agricultural practices, seed preservation, food security, water resource conservation, forest management, soil conservation, conservation of animals and birds, biodiversity conservation, Disaster management and community based decision-making processes etc. Data collection methods are applied ethnographic involving interview, questionnaires Survey, Focus Group Discussions and analysis of Oral History in this study. Data derived from field have been analysed in qualitative methods. This study highlights how integrating their Indigenous Knowledge Systems and traditional practices with modern policy frameworks can enhance climate resilience and sustainable livelihoods in vulnerable regions.*

**Keywords:** Sustainable Development, Climate Change Adaptation, Santal IKS, Traditional Practices

### **Introduction:**

The Intersection between Indigenous Knowledge Systems (IKS) and modern environmental governance has become increasingly prominent in sustainable development discourse. The Santals are third of the largest in number among the Indigenous communities who live mainly in the states of Jharkhand, West Bengal, Bihar, Odisha and Assam and Union Territories in India. They also live in neighbouring countries like Bangladesh and Nepal (known as Satar in Nepal), Bhutan, and Myanmar etc. This community are coming from

Munda linguistic group and they are speaking the Santali language. Its language is under the Munda language group. Everywhere they introduce themselves as 'Hor' which means 'man'. In the opinion of Suniti Kumar Chatterjee, the linguist, the word 'Santal' probably originated from Sanskrit word '*Samantapal*' or the border Security. In the Mediaeval ages this '*Samantapal*' broke into '*Samanta -Al*' and later '*Sawantal*' and ultimately became '*Santal*'. According to Santals heritage, they originated from the '*Kherwar*' stream. Santals also introduce themselves as '*Kherwal*'. In the era of globalisation and capitalism, the earth is poisoned with the harmful activities of humans. Climate change is a global concern at the present circumstance. The issues of global warming, overpopulation, overconsumption, and greenhouse gas emissions have been increasing rapidly. The decreasing of forests impacted wildlife habitation, rising temperature, melting ice caps, and species loss. The climate crisis is a threat to human, animal, and plant extinction. The ecological imbalances have been happening through wars, air pollution, and plastic pollution. Excessive carbon usage impacts the environment. Human survival in a changing climate is the greatest global crisis. The rising sea level, drought, unpredicted weather change, heat waves, and wildfires are some consequences of climate change. The critical catastrophe of environmental change increasingly has been affecting the earth's geography and society (Saren). The Santals possess traditional ecological knowledge that contributes to environmental sustainability, agricultural practices, seed preservation, food security, water resource conservation, forest management, soil conservation, conservation of animals and birds, biodiversity conservation, Disaster management and community based decision-making processes etc. This study highlights how integrating their Indigenous Knowledge Systems and traditional practices with modern policy frameworks can enhance climate resilience and sustainable livelihoods in vulnerable regions. This paper explores the role of the Santal Indigenous Knowledge Systems (IKS) and traditional practices in promoting sustainable development and climate change adaptation.

### **I. Research Problem:**

1. The issues of global warming, overpopulation, overconsumption, and greenhouse gas emissions have been increasing rapidly.
2. The decreasing of forests impacted wildlife habitation, rising temperature, melting ice caps, and species loss.
3. The climate crisis is a threat to human, animal, and plant extinction.
4. The ecological imbalances have been happening through wars, air pollution, and plastic pollution.
5. Excessive carbon usage impacts the environment.

### **II. Objectives of study:**

1. To identify the Santal Indigenous Knowledge Systems and Traditional Practices for Sustainable Development and Climate Change Adaptation.
2. To analyse the Santals Indigenous Knowledge Systems and traditional practices.
3. To evaluate the Santal Indigenous Knowledge Systems and Traditional Practices
4. To apply Santal Indigenous Knowledge Systems and traditional practices for Sustainable Development and Climate Change Adaptation.
5. To highlight the significance of the Santal Indigenous knowledge Systems and Traditional Practices for environment conservation

**III. Methodology:** Data collection methods are applied ethnographic involving interview, questionnaires Survey, Focus Group Discussions and analysis of Oral History in this study. It is descriptive in nature and is based on in-depth literature review. Relevant information and materials were collected from various sources incorporating books, journals, records, conference proceedings, articles and web-based sources. Data derived from field have been analysed in qualitative methods.

**IV. Results and Discussions:**

Sustainable development, as defined by the Brundtland Commission (1987), aligns with the Santal worldview of intergenerational equity and balance with nature. Their collective land ownership models, resource sharing, and ritual-based environmental stewardship support sustainability not just ecologically, but also socially and culturally. The incorporation of Indigenous voices in development projects-via co-management or participatory governance is increasingly advocated in recent literature (UNDRIP, 2007 & FAO, 2021). The Sustainable Development Goals (SDGs) are a set of 17 global goals adopted by United Nations member states in 2015 as part of the 2030 Agenda for Sustainable Development. They aim to end poverty, protect the planet and ensure peace and prosperity for all by 2030.

**Table 1. Sustainable Development 17 Goals (SDGs):**

Sl. No. of SDGs	SDGs	Explanation
1	No Poverty	End poverty in all its forms everywhere
2	Zero Hunger	End hunger, achieve food security and promote nutrition
3	Good Health and Well-being	Ensure healthy lives and promote well-being for all
4	Quality Education	Provide inclusive and equitable quality education for all
5	Gender Equality	Achieve gender equality and empower all women and girls
6	Clean Water and sanitation	Ensure availability and sustainable management of water and sanitation
7	Affordable and clean Energy	Ensure access to sustainable and modern energy
8	Decent Work and Economic Growth	Promote sustained economic growth and decent work for all
9	Industry, Innovation and Infrastructure	Built resilient infrastructure and promote innovation
10	Reduced Inequalities	Reduce inequality within and among country
11	Sustainable Cities and Communities	Make cities inclusive, safe, resilient and sustainable

12	Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13	Climate Action	Take urgent action to combat climate change and its impacts
14	Life Below water	Conserve and sustainably use oceans, seas and marine resources
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems
16	Peace, Justice and Strong Institutions	Promote peaceful and inclusive societies and build strong institutions
17	Partnerships for the Goals	Strengthen global partnerships to support and achieve the SDGs

**Table 2. Santal Practices with the UN Sustainable Development Goals (SDGs):**

Sl. No	Santal Practice	Related SDG	Explanation
1	Organic farming	SDG2(Zero Hunger), SDG15 (Life on Land)	Enhances food Security and conserves soil
2	Water harvesting	SDG6(Clean Water)	Ensures year-round water availability
3	Community governance	SDG16(Peace, Justice)	Promotes inclusive and participatory decision-making
4	Herbal medicine	SDG3(Health)	Affordable, accessible primary health care
5	Forest stewardship	SDG13(Climate Action)	Carbon sequestration and biodiversity conservation

### **Santal Indigenous Knowledge Systems (IKS):**

Climate change disproportionately affects Indigenous communities, especially those with resource-dependent livelihoods. Research by the IPCC (AR6, 2022) acknowledges that Indigenous knowledge can play a pivotal role in climate adaptation strategies, especially in the Global South. For the Santals, increasing instances of erratic rainfall, rising temperatures, and biodiversity loss threaten their agricultural patterns and traditional livelihoods. However, their adaptive capacity, rooted in communal knowledge and flexible agricultural systems, provides valuable lessons in resilience. Scholars such as Berkes (1999) and Agrawal (1995) have long advocated for the recognition of Indigenous Knowledge Systems as valid and essential components of environmental management. Indigenous knowledge is cumulative, dynamic, and context-specific, often passed down orally and through cultural practices. In the Santal context, knowledge is embedded in their cosmology, social norms, and seasonal rituals. This includes knowledge of agro-ecology, forest management, seed

preservation, and water conservation- practices defined over centuries in response to local environment changes.

### 1. Traditional Ecological Knowledge:

Studies by Kisku (2019) and Basu (2020) have documented how Santal communities respond to climate changes through traditional early warning system (e.g., interpreting animal behaviour or Plant flowering), soil fertility management, and collective farming practices.

#### a) Indigenous indicators to predict rain:

- In years when the wind blows from north, winter arrives early. That's why Santals don't keep their doors or windows facing north.
- The appearance of fresh leaves and flowers after the leaves fall indicates the arrival of spring.
- If the *Lata Palash* fruit has seeds throughout, there will be consistent and heavy rainfall throughout the year. If the fruit has no seeds, there will be abundant sunshine. If the seeds are at the beginning of the fruit, rainfall will be early in the monsoon season, and if they are at the end, the rain will be towards the end of the season. If there are no seeds, there will be no rainfall during the monsoon season, only sunshine.
- In the year when mango trees bear a large number of flowers evenly, there is uniform rainfall across India. If the *bakul* tree does not blossom on the eastern branch, there will be rainfall in eastern India.
- If the paddy hispa feeds (*Sharhi Poka*) on the back of the rice, the monsoon will arrive late; but if it feeds on head or front of paddy, the monsoon will arrive early.
- The *Lipi* bird builds its nest with the back facing the direction from which the monsoon comes and the front facing the direction from which neither wind nor rain will come. By observing the *Lipi* bird's nest, the Santals could tell from which direction the monsoon or wind might arrive.
- In the year when there will be drought or late rainfall, the *Chan chir* bird builds its nest in the hollows of buffalo hoofprints.
- In a year when the *Sugi* bird calls from inside a bush during the months of *Jhet* and *Bhadra*, the monsoon will arrive early; but in a year when the bird calls while sitting on a branch or a dead branch, there will be very little rainfall.
- If in the evening or at night the *dahuk* bird *Koyak Koyak* calls while moving around, that year there will be heavy rainfall. But if it calls with a grunting sound (*Khor Khor*) while sitting on a tree branch or on top of a bush, then that year there will be very little rainfall.
- If there are large trees, there will be good rainfall.
- If, in the month of *Kartik*, a bear digs the ground with its paw in one spot and leaves the soil there, then there will be no rainfall that year. But if it digs the ground with its paw and throws the soil nearby or if rainfall comes from the direction in which the soil has been thrown, then that year it will rain from that direction. And if the dug-up soil is thrown far away, there will be rainfall over a wide area.

- If in a certain year the *Shikar Poka* (Hunting insect) falls from the tree to the ground in the forest, that year there will be abundant rainfall.
- If in a certain year caterpillars (*Shuya Poka*) are found all over the *Sahara* tree from bottom to top, there will be heavy rainfall that year.
- If, in any year on *Makar Sankranti*, a fox calls in the open field, that year there will be very little rainfall. But if it calls towards a swamp or a riverbank, there will be abundant rainfall.
- If black ants carry their eggs up onto a tree or some other place, the Santals understand from this that it will rain.
- 

**b) Indigenous indicators to predict drought:**

- The year when tamarind trees bear fruit in abundance, the following year the amount of rainfall will be less or there will be a drought.
- If in a certain year the seeds of the *Lata Palash* fruit are completely shriveled or contain no kernels inside, that year there will be drought.

**c) Indigenous indicators to predict flood:**

- The year when the *Dhongkar* bird roams around cultivated fields, there is heavy rainfall, and sometimes even floods occur.
- The year mango trees bear an abundance of flowers and fruits, there is heavy rainfall, sometimes even leading to floods.

**d) Indigenous indicators to identify of soil fertility:**

- The soil where earthworms are abundant contains more humus or organic fertilizer.
- The soil that is black and sticky appearance has a greater capacity to retain water, making it suitable for cultivation. On the other hand, the soil that is white and sticky is not good.

**e) Indigenous indicators to assess water quality:**

- If the water of a spring water is thin, it tastes sweet, and if it thick, it does not taste sweet.
- If a spring is dug in a river or a stream, it is called *Such Dadi*. The water of this is sweet.
- If a spring is dug in a damp or moist place the water lasts for a long time.



Figure 1. *Dadi* (Spring water)

**f) Indigenous indicators to identify quality of forest resources (tree and wild life):**

Trees in the forest with hard trunks were used for making furniture and other constructions. The leaves, flowers, fruits, bark, or skin of the trees were for various purposes. By observing these, the Santal people in earlier times determined the quality of the wood.

- The wood of the Sal tree is used for building houses, making ploughs, and various household furniture. The flowers of the Sal tree are used in worship, and its fruits are also used as medicine.
- The wood of the Mahua tree is used for making furniture. Various kinds of food and different drinks are prepared from Mahua flowers. Mahua fruit is cooked as a vegetable, and oil is extracted from its seeds. Mahua oil is also used as medicine.
- The Kendu fruit is eaten. Kendu leaves are used for making *Biri*(bidis).
- The *Piyal* fruit is edible. The wood of the *Piyal* tree is used to making various essential posts and the yoke of a plough.
- *Bhelai* fruits are eaten. Medicine is made from the seeds of *Bhelai* fruits.
- The leaves of the *Arjun* tree are used as medicine, and even the juice of *Arjun* leaves is used for creating various *Alpana* (decorative designs). The wood of the *Arjun* tree is used for various purposes in house construction.
- The Banyan fruit is eaten, and wine is made from it.
- The tender leaves are eaten as a leafy vegetable.
- The forest cattle were tamed and used for farming. Moreover, various kinds of musical instruments were made from cowhide. The forest buffalo was also tamed and used for farming. In addition, different kinds of musical instruments were from it hide a horn. The wild boar was domesticated for meat construction.
- Goats, ducks, chickens, and various wild animals were domesticated for meat. Peacocks were domesticated for their beauty, and dogs were domesticated for hunting.

**g) Indigenous indicators to natural hazards:**

- When it seen that black ants are carrying their eggs into a hole or a term mound, it means that a strong wind will blow.
- When the cows run around a lot in the field, it indicates that a severe storm, heavy rain, or even a cyclone may occur.
- When cows in the cowshed bellow at night or keep fidgeting, it indicates that an earthquake may occur.

These strategies reflect “Autonomous Adaptation” local responses developed without external aid which are crucial in remote and resource-scarce regions. Traditional weather forecasting and land-use patterns help mitigate risks related to floods, droughts, and soil erosion.

**h) Indigenous indicators to build heat resistant house:**

The Santal build houses for temperature control with walls 1.5 to 2 feet thick and roofs made of 6-inch mud plaster and thatch.



Figure 2. Santal Indigenous house structure

**i) Indigenous methods of pest control in houses:**

The Santals offers evening incense with Sal tree resin. In addition, in evening they make a burner out of broken clay pots or shells, in which they put different kinds of leaves such as (*Sindari*) *Sindri* leaves and *neem* leaves, set them on fire, and let the whole house fill with smoke. This smoke acts as a natural pest control inside the house.

**j) Indigenous methods of water treatment:**

When the water of a spiring or a well becomes polluted, they clean the spiring or the well by repeatedly removing the water, and in this way, they carry out water treatment.

- 1. Agricultural Practices:** According to the Santals, land is mainly of three types- *Goda* or *Tora*, *Barge*, and *Khet*. *Goda* refers to *Tora* or hilly land. *Barge* means the land around the courtyard of house. *Khet*: This type of land is of three kinds like *Baid*, *Sakra* and *Baihar* (*Sole*). The Santals used to observe the types of land to predict what kind of rainfall might occur in a given year, and accordingly decided what crops to cultivate on which land.
- 2. Santal Indigenous foods:**

**Table 3. Santal Indigenous Food and Beverage in Santal Community:**

Sl. No.	Food Type	Name of foods
1	Rice	Rice, <i>Jandra Damadi</i> , <i>Guhum Damadi</i> , <i>Iri Gudli</i>
2	Cake	<i>Jil Pitha</i> , <i>Dubuh</i> ( <i>Tilming</i> , <i>Narkel</i> ), <i>Purpitha</i> , <i>Lau Pitha</i> , <i>Sim Patha</i> , <i>Bakre Pitha</i> ( <i>Kuidi</i> ), <i>Khapra</i> ,
3	Dry food	<i>Janum Lubuh</i> , <i>Matkam Lathe</i> , <i>Jandra</i> , <i>Jandra Lubuh</i> , <i>Bajra</i>
4	Green leafy vegetables ( <i>Shak</i> )	<i>Kidup</i> , <i>Matha</i> , <i>Guyagidhari</i> , <i>Chakanda</i> , <i>Kantha</i> , <i>Much</i> , <i>Garundi</i> , <i>Lapang</i> , <i>Path</i> , <i>Shing</i> , <i>Munga</i> , <i>Hesha</i> , <i>Lau</i> , <i>Kumra</i> , <i>Alu</i> , <i>Gadhari</i> , <i>Kuilakhara</i> , <i>Turi</i> , <i>Kumra shak</i> , <i>Dhurup</i> , <i>Shirgiti</i> , <i>Khapra</i> , <i>Bahu Tuturi</i> , <i>Nim Shak</i> , <i>Gimah</i>
5	Vegetables	<i>Jhi Kalla</i> , <i>Bir Kudri</i> , <i>Bakre(kuidi)</i> ,
6	Fruits	<i>Terel</i> , <i>Tarap</i> , <i>Shasha</i> , <i>Merlech</i> , <i>Lapang</i> , <i>Bare</i> , <i>Aam</i> , <i>Jam</i> , <i>Kathal</i> , <i>Janum</i> , <i>Bel</i> , <i>Dumur</i> , <i>Chaltha</i> , <i>Bhundru</i> , <i>Khejur</i> , <i>Kuritrama Janum</i>
7	<i>Mul</i> (Roots)	<i>Sang Alu</i> , <i>Baula</i> , <i>Mitha Alu</i> ( <i>Sakarkada</i> ), <i>Pede</i> , <i>Sharu(alti)</i>
8	Oils	<i>Baru</i> , <i>Kuidi</i> , <i>Neem</i> , <i>Kujri</i> , <i>Jada</i> , <i>Kudrum</i>
9	Mushroom	<i>Matam</i> , <i>Patka</i> , <i>Sagag</i> , <i>Tarmah</i> , <i>Baula</i> , <i>Sim</i> , <i>Artuh</i> , <i>Basup</i> , <i>Muchi</i> , <i>Kath</i> , <i>Putka</i>
10	Birds	<i>Gundri</i> , <i>Chitri</i> , <i>Patam</i> , <i>Paira</i> , <i>Gihu</i> , <i>Dahuk</i> , <i>Bak</i> ,
11	Animals	<i>Sonabank</i> , <i>Goat</i> , <i>Murgi</i> , <i>Hash</i> , <i>Pig</i> , <i>Khek Shial</i> , <i>Runda</i> , <i>Rim Sim</i> , <i>Bana</i> , <i>Hadgar</i> , <i>Hargar</i> , <i>Sagah</i>

12	Fish	Rui, Katla, Magur, Chirka, Geto, Pati, Darka, Lulhi, Duri, Kuchla, Gadai, Bain, Bhua, Icha
13	Snake	Gosap, Jambru. Kachhap
14	Kakra or Gugli	Katkom, Jhenuk Katla, Rakach, Gangha
15	Madhu oil	Teram, Nele
17	Pipire	Hau
18	Leto (with halang)	Jil, Putka, Hau, Rakach, Gangha, Khargosh khelopata, Khudrum (Fruits Chhal)
19	Dal	Raher, Kutthi, Mugdal, Brihi, Sim, Ghagra
20	Beverage	Handi, Mahua (Poura)
21	Sore Daka (Khechuri)	Jil Sore, Putka, Ud, Sing arah, Garundi, Matha Arah, Raher,

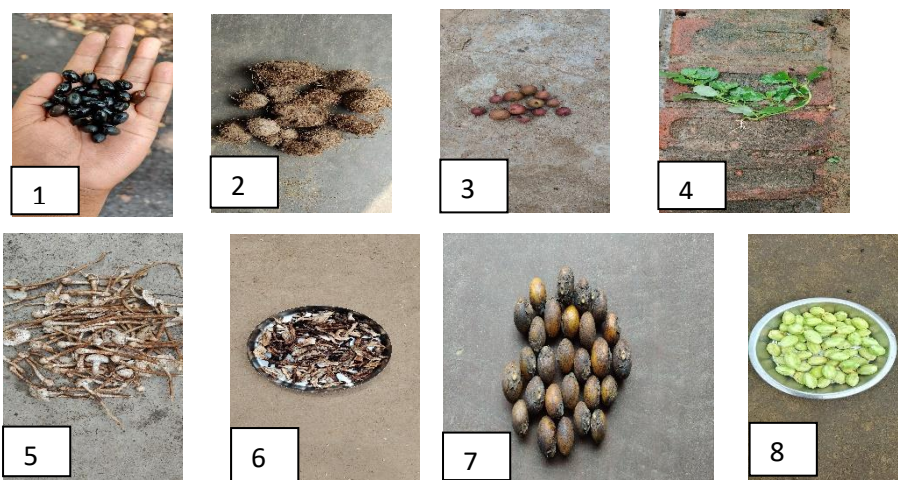


Figure 3. Santal Indigenous Food and Beverage (1. Bon Khejur, 2. Baula, 3. Loya Fruits, 4. Khapra Shak, 5. Mushroom, 6. Amshi, 7. Kendu Fruit and 8. Mahua fruit).

**3. Natural medicine:** Use of local herbs and healing rituals by the Santal community.

**Table 4. Disease and Medicinal plants by Santals IKS:**

Sl. No.	Name of Disease	Local herbs or Medicinal Plants and roots
1	Kukur Kamrale	1. Dumra
2	Snake Kamrale	1. Iswar mullik gad pata 2. Saram lutur 3. Swarpa gandha
3	Date Poka or Rigud	1. Dumra 2. Pan pata data 3. Siram Dandhi root
4	Baccha hower por ful na porle or Garve Baccha mara porle	1. Bare Baha
5	Arsha	1. Lapang Shak
6	Shira Betha	1. Tejumala Root 2. Kujri oil (Khowa and Malish)

7	Gurmi or Lah Faska like Basanta (chaleder Gopan Ange hale)	1. Bheda Dereng Pata 2. Kalo gira 3. Pustu 4. Dar chini chal 5. Pod kawed root 6. 100-gram chini(1 to 6 Khowa) 7. Nagolia root 8. Master oil (7 ar 8 boiling kare Lagate habe)
8	Dhatu	1. Kalo gira 2. Pustu 3. Dar chini chal 4. Pod kawed root 5. 100-gram chini
9	Baccha howar por Mayer dut na hale	1. Puthi mach(1ti or 3ti) 2. Kalo gira
10	Pox or Basanta	1. Rigani or Bich Bigun (all part white) 2. Golmurich(2.5 ti)
11	Antri or Cop Amasay or Rakta Amasay	1. Charankag shak 2. Bir Peyach 3. Jam chal 4. Janum chal 5. Janum Gidhari root
12	Breast e Gulti Gulti hale or Breast khub betha hale or Mayer dut bandha karar janyo	1. Tejumala root
13	Brilliant or Jate buddi hoi	1. Brahmin shak
14	Sugar	1. Kari pata 2. Thankuni pata
15	Peth gab	1. Thankuni pata 2. Nari Murga chal
16	Peth Gha	1. Nari Murga chal
17	Thanda Lagle	1. Tulsi pata
18	Jor or Fever (Man)	1. Siuli pata Satta
19	Surhi	1. Taya palak 2. Coconut oil
20	Goru lege Gandra or Poka	1. Taya Palak 2. Coconut oil
21	Goru payer khurate poka	1. Kushni Flower Sataa or Ras
22	Machke gele	1. Paja chal 2. Haidkan chal
23	Patla paikhana or Pet kharab	1. Agir doga 2. Jam or Kud doga
24	Jib Gha	1. Nari Murga chal
25	Puni	1. Peter Fruit
26	Tanoni	1. Kujri oil (Khowa and Malish)
27	Idur kamrale or Chud or chicho kamrale	1. Hat chal

28	Nasha	1. Dhurup root (satta nakhe droop karte habe)
29	Adkopali matha betha	1. Kunkal orak chhuriye purba dike mukh kare dharna thakur nam kare purba theke paschim dike mathar upor diye fele dite habe ar pichoner dike takano jabe na(Vore ulanga kare karte habe)
30	Gass	1. Thankuni pata (3 ti or 4 ti)
31	Snake Bish kamanor janyo or Jate taratari na uthe	2. Rohni Fruit 3. Baola root
32	Liver Gha or Liver Problems	1. Ral Fruit (Hattaki) 2. Lapang Fruit (Barha) 3. Meral Fruit (Amlaki)
33	Sardi	1. Basak pata satta
34	Vurun Nasto	1. Chirchitig root
35	Hemoglobin	1. Kuilakhada shak 2. Guyagidhari 3. Lao shake r dag
36	Ghao or Teju	1. Jhathni root 2. Master oil
37	Kete Gele or Ged	3. Nirbish root 4. Dhubi Grass 5. Dhura 6. Master oil
38	Puj	1. Siram Dandhi root
39	Rukho or Jhala (Rod lege gele)	1. Janum chal
40	Goat or Cow patla paikhana	2. Sal fruit
41	Pig er mukh theke fena berole	3. Chatim gach er chal
42	Heart care	1. Arjun chal er satta
43	Har Sakta	1. Kul gacher kat puriye angra diye sek
44	Dental care	1. Babla patar doga 2. Ghetu gach er datan
45	Har vege gele	1. Haidkal chal
46	Pox hoyar por je kalo dag hoi segula chole jai	1. Kacchap or tortoise er khola pathare ghashe guro kare lagate habe.
47	Fever (Goat ar Cow)	1. Paja fruit
48	Patla Paikhana (Goat and Cow)	1. Sal fruit 2. Jhul
49	Pain killer oil	1. Mahua, Nim, Kusum oil mixed 2. Gosap er chorbi oil
50	Paralysis	1. Kulkat er angra diye sek 2. Kujri oil 3. Kachra oil 4. Kusum oil
51	Blood Cancer	1. Hatilutur root 2. Pushikata root

52	Jandish	1. <i>Jandish pata</i> 2. <i>Laukesari pata ros</i> 3. <i>Kala pata ros</i> 4. <i>Raher pata ros</i>
53	<i>Ekashira</i>	1. <i>Golmarich 21 ti</i> 2. <i>Begna root or Sidhori root</i>
54	<i>Hat or Pa bhege gele</i>	1. <i>Legra root</i> 2. <i>Haikal root</i>
55	<i>Jalon Chitka</i>	1. <i>Shar Kurchi chal</i> 2. <i>Kachli akher Gur</i>

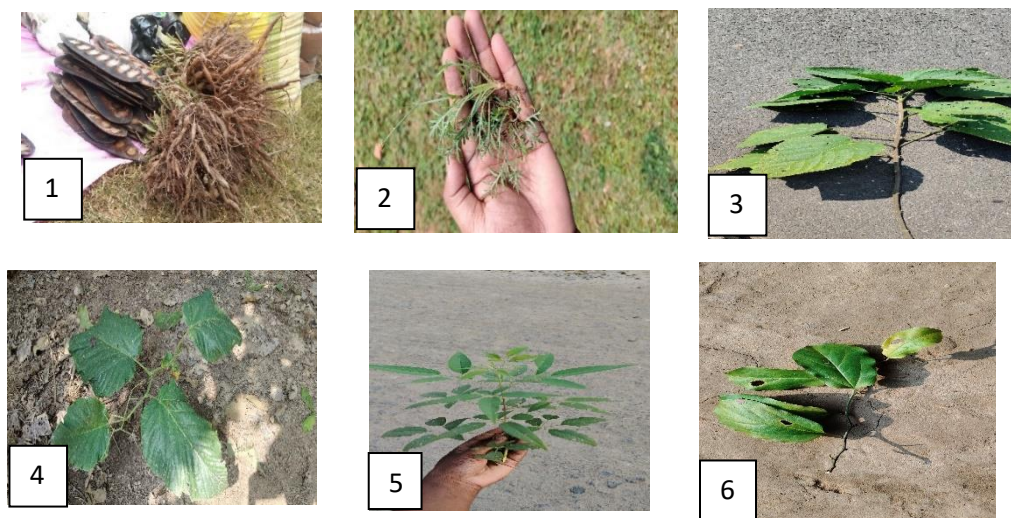


Figure 4. Local herbs or Medicinal Plants and roots (1. *Dhumpu Root*, 2. *Tandi Kushni*, 3. *Hatu tree*, 4. *Haitkal*, 5. *Sindari* and 6. *Iswarmulli*)

4. **Forest and biodiversity conservation:** Joint Forest Management and Sacred Groves
5. **Water Conservation:** Traditional rainwater harvesting, sacred ponds.
6. **Disaster risk reduction:** Early warning signs from animal behaviour or natural indicators.
7. **Ecological management:**

Recent ethnographic and ecological studies (Murmu, 2017 & Hansda, 2021) show how Santal agricultural practices are based on principles of biodiversity, crop rotation, intercropping, and the preservation of native seeds. Their farming techniques are low-input, non-industrial, and environmentally friendly. Santal communities also follow sacred groves practices, where patches of forests are preserved due to spiritual beliefs, effectively functioning as community-conserved areas. These sacred spaces promote biodiversity conservation and serve as micro-climate buffers, contributing to ecosystem resilience.

***Jaher Than (Sacred Groves):***

*Jaher Than*, the abode of the principal deities, is a cluster of trees, usually a part of the primeval forest. It is essential that it include five trees, four *sal* and one *mahua*. A stone for one deity is placed at the foot of each. Three *sal* trees must be in a row, and are meant for *Jaher Era* (the Lady of the grove), *Marang Buru* and *Moreko-*

*Turuiko*. A fourth *sal* tree standing somewhere near is for the *Pargana Bonga* and the mahua tree is reserved for *Gosai Era* (Datta-Majumder, 1956).



Figure 5. Jaher Than

**Table 5. Santal Clan, Totem and Taboo (Ghosh& Ghosh, 2000):**

Sl. No.	Sib or clan	Clan totem	Taboo
1	Hansda	Wild goose or duck	Worship
2	Murmu	Nilgai	Worship
3	Kisku	Golden Eagle	Worship
4	Hembram	Betel Palm	No Cutting
5	Mandi	Grass	
6	Pauria	Pigeon	No Killed
7	Saren	Constellation	Worship
8	Tudu	No finding	No finding
9	Baskey	Watered rice	No Cutting
10	Besra	Hawk	
11	Chore	Lizard	No Killed
12	Bedea	Sheep	No Killed

**Table 6. Importance of Indigenous Knowledge Systems (IKS):**

Sl. No.	Field	IKS Contribution
1	Environment	Biodiversity conservation, forest management, Climate adaptation
2	Agriculture	Resilient farming, seed sovereignty, pest control
3	Health	Herbal remedies, midwifery, community health practices
4	Socio-Cultural Identity	Preserves languages, rituals and community structures
5	Climate Change	Local adaptation strategies, ecosystem, restoration
6	Sustainable Development	Low-carbon life circular use of resources

#### 8. Community governance and Spiritual values:

Trees such as *Sal*, *Mahua*, *Kendu*, *pial*, *belai*, *aswattha*, *kusum*, *bhunduru*, *arjun*, and *sheuli* hold significant religious, social, and economic value in the Santal community. Specific trees are associated with particular rituals and ceremonies:

for instance, *Sal*, *Mahua* and *Hesech Sekrech* trees are integral to wedding rituals, while *Sal*, *Mahua*, *kendu*, and *arjun* trees are central to the *Jaher Than* (Sacred grove). Similarly, *Sal* flowers and *Mahua* flowers are indispensable for *Baha* festival. Furthermore, the Santal society is divided into twelve clans, each possessing its own distinct religious symbols and taboos, which regulate cultural practices and identity.

### Climate Change Adaptation through Santal Traditional Practices:

1. **Shifting cropping patterns:** Based on climate signals.
2. **Traditional farming calendars and seed preservation:**
3. Uses of drought-resistant indigenous seed varieties.
4. **Sacred groves** as micro-climate buffers. The Santals do not cut the trees that are used in worship. Moreover, since each clan has its own taboos, tree cutting is prohibited according to those taboos. For example, the people of the Murmu clan worship the Palash tree, and therefore they do not cut it.
5. **Oral weather forecasting through natural indicators** (e.g., bird migration, flowering patterns)
6. **Seasonal migration and labour-sharing systems** to manage economic shocks.

### V. Findings of the study:

Despite its value, Santal Indigenous Knowledge often faces marginalization in mainstream policy and academic discourses. Factors include:

1. **Global Warming:** Average global temperature has risen by over 1.1 °c since the pre-industrial era.
2. **Sea-Level Rise:** Melting glaciers and thermal expansion of seawater.
3. **Extreme Weather:** More frequent and intense storms, heatwaves, droughts and floods.
4. **Ocean Acidification:** CO<sub>2</sub> absorption makes oceans more acidic, harming marine life.
5. **Biodiversity Loss:** Disruption of ecosystems and species extinction.
6. **Loss of traditional lands** due to industrial development.
7. Cultural assimilation and erosion of oral traditions.
8. Limited representation in environment decision-making.

### VI. Conclusion:

This study highlights how integrating their Indigenous Knowledge Systems and traditional practices with modern policy frameworks can enhance climate resilience and sustainable livelihoods in vulnerable regions. Among these Systems, the Santal Knowledge-rooted in the socio-ecological practices of the Santal people offers a localized, holistic approach to managing environmental resources, adapting to climate variability, and sustaining livelihoods. This paper explores the role of the Santal Indigenous Knowledge Systems (IKS) and traditional practices in promoting sustainability and enhancing resilience to climate change.

There is also a lack of structured documentation of Santal Knowledge Systems, which impedes their recognition in formal climate change adaptation frameworks.

### Integrating Santal IKS and Traditional Practices into modern frameworks:

1. **Policy recognition:** Include IKS in national and local climate adaptation strategies.
2. **Documentation and research:** Community-led initiatives to record oral traditions
3. **Education reforms:** Culturally responsive curricula in schools, Colleges and Universities.
4. **Collaborative models:** NGOs and government working with Santal communities on equal terms.

## **References:**

1. Agrawal, A. (1995). Dismantling the Divide Between Indigenous and Scientific Knowledge. *Development and Change*.
2. Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*.
3. Datta-Majumder, N. (1956). *The Santal: A Study in Culture-Change*, The Manager of Publications, Delhi.
4. Bodding, P. O. (1925). *Studies in Santal Medicine and Connected Folklore*. The Asiatic Society, Kolkata.
5. Ghosh, G. K. & Ghosh, S. (2000). *Legends of Origin of the Castes and Tribes of Eastern India*, Firm KLM Private Limited, Calcutta.
6. Hansda, B. (2021). Santal Indigenous Practices and Agro-Ecological Sustainability in Jharkhand. *Journal of Tribal Studies*.
7. Kisku, B. (2019). Climate Change and Indigenous Knowledge: A Study among the Santal. *Indian Anthropologist*.
8. Murmu, R. (2017). Environmental Conservation in Santal Traditional Practices. *Journal of Adivasi and Indigenous Studies*.
9. Saren, S. The Role of Santal Indigenous Knowledge for Environment Conservation and Global Integration, *Role of Libraries in Unveiling Indian Knowledge Systems*, p. 470-475.
10. UNDRIP (2007). *United Nations Declaration on the Rights of Indigenous Peoples*.
11. FAO (2021). *Indigenous Peoples' Food Systems: Insights on Sustainability and Resilience*.
12. IPCC (2022). *AR6 Working Group II Report: Impacts, Adaptation Vulnerability*.