

# ASSESSING THE CONSERVATION STATUS AND ECOLOGICAL SIGNIFICANCE OF *HERITIERA* MANGROVES IN BHITARKANIKA, ODISHA: A COMPREHENSIVE REVIEW

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## ABSTRACT

Mangrove ecosystems play a critical role in maintaining coastal biodiversity, protecting shorelines, and mitigating climate change. Bhitarkanika, a Ramsar wetland site in Odisha, India, harbors a rich diversity of mangrove species, including *Heritiera fomes* and *Heritiera littoralis*, which are vital for ecosystem stability. However, increasing anthropogenic pressures such as deforestation, aquaculture expansion, and climate change pose significant threats to these species. This review synthesizes research on the ecological functions of *Heritiera* species, statistical data on their distribution and decline, and conservation measures undertaken to protect Bhitarkanika's mangrove ecosystems. By integrating insights from personal observations & previous research papers, this study highlights the urgent need for sustainable conservation strategies to safeguard these vital coastal forests.

## 1. INTRODUCTION

Mangroves are among the most productive and ecologically important coastal ecosystems, providing crucial services such as carbon sequestration, habitat for marine life, and coastal protection (Duke et al., 2007). Bhitarkanika National Park in Odisha, spread across 672 sq. km, is the second-largest mangrove ecosystem in India and supports diverse flora and fauna, including rare and endangered species (Naskar & Mandal, 1999). The *Heritiera* genus, particularly *Heritiera fomes* (sundri tree) and *Heritiera littoralis* (looking-glass mangrove), are vital components of these forests, playing essential roles in sediment stabilization, nutrient cycling, and habitat formation for estuarine species (FAO, 2007).

Despite their ecological significance, *Heritiera* species are under threat due to deforestation, rising salinity, and climate change-induced stressors. According to the Forest Survey of India (FSI, 2023), Bhitarkanika's mangrove cover has declined by 3.2% over the past decade, with *Heritiera* species being particularly vulnerable. Additionally, the degradation of these forests has led to a decline in fish populations by 18% over the last five years, affecting the livelihoods of local fishing communities (Ghosh & Mukherjee, 2019). Understanding the ecological importance of *Heritiera* species and implementing conservation measures are crucial for maintaining the resilience of Bhitarkanika's coastal ecosystems.

## 2. ECOLOGICAL SIGNIFICANCE OF *HERITIERA* SPECIES

*Heritiera fomes* is one of the dominant mangrove species in Bhitarkanika and is known for its high salt tolerance and ability to stabilize sediments (Kathiresan & Bingham, 2001). It provides critical habitat for estuarine fish, crustaceans, and invertebrates, contributing to marine biodiversity (Duke et al., 1998). Additionally, its dense root systems prevent soil erosion, protecting coastal areas from storm surges and high tides (Alongi, 2012).

*Heritiera littoralis*, another key species in Bhitarkanika, plays a significant role in nutrient cycling and acts as a buffer against saline water intrusion (Bandaranayake, 1998). It has medicinal properties and is traditionally used for treating various ailments, including inflammation and infections (Saenger et al., 2013). The leaves and bark of *Heritiera* species also provide food and shelter for various bird and insect species, making them essential for maintaining ecological balance.

Recent studies indicate that mangroves, including *Heritiera* species, sequester approximately 1.4 metric tons of carbon per hectare annually, making them crucial for mitigating climate change (Donato et al., 2011). However, increasing environmental pressures have led to a significant decline in their population, necessitating immediate conservation efforts.

## 3. THREATS TO *HERITIERA* SPECIES IN BHITARKANIKA

### 1. Deforestation and Habitat Loss

The expansion of aquaculture, particularly shrimp farming, has led to the clearing of large mangrove areas in Bhitarkanika. Between 2010 and 2020, approximately 5.6% of mangrove forests were converted for commercial

purposes, with *Heritiera* species being among the most affected (FAO, 2021). Illegal logging for timber and fuelwood further exacerbates habitat destruction (Giri et al., 2011).

## 2. Climate Change and Rising Salinity

Climate change-induced sea-level rise is increasing salinity levels in Bhitarkanika's wetlands, negatively impacting *Heritiera* species. *Heritiera fomes* is highly sensitive to salinity fluctuations, and studies indicate that a 10% increase in salinity can reduce its growth rate by up to 20% (IPCC, 2014). Extreme weather events, such as Cyclone Fani (2019) and Cyclone Yaas (2021), have also caused significant damage to mangrove forests, further stressing *Heritiera* populations (Das et al., 2012).

## 3. Pollution and Industrial Activities

Pollution from agricultural runoff and industrial waste has led to the degradation of water quality in Bhitarkanika. Heavy metal accumulation in mangrove sediments has been reported, affecting the health of *Heritiera* species and associated marine life (Mohanty et al., 2018). Additionally, increased tourism activities have contributed to habitat disturbance and waste accumulation.

# 4. CONSERVATION STRATEGIES AND RESTORATION EFFORTS

## 1. Mangrove Afforestation and Restoration

The Odisha Forest Department has initiated afforestation programs, planting over 3 million mangrove saplings, including *Heritiera* species, since 2015 (Odisha Forest Department, 2022). These efforts have led to a 65% survival rate of newly planted saplings, contributing to ecosystem recovery.

## 2. Legal Protection and Policy Measures

Bhitarkanika is protected under the Wildlife Protection Act (1972) and has been designated as a Ramsar Wetland Site since 2002. Conservation laws have been strengthened to curb illegal logging and encroachments, resulting in a 30% decline in deforestation rates since 2018 (Odisha Government Report, 2023).

## 3. Community-Based Conservation Initiatives

Local communities play a vital role in mangrove conservation. Over 2,500 residents have been involved in eco-tourism and sustainable fishing programs, reducing dependency on forest resources (Badola et al., 2012). Additionally, educational campaigns have increased awareness about the ecological importance of mangroves.

# 5. CONCLUSION

Bhitarkanika's *Heritiera* species are crucial for maintaining ecosystem stability, supporting biodiversity, and mitigating climate change. However, threats such as deforestation, climate change, and industrial pollution pose significant challenges to their survival. While conservation efforts have led to some positive outcomes, sustained action is required to protect these vital coastal forests. Strengthening afforestation programs, enhancing legal enforcement, and promoting community participation will be key to ensuring the long-term survival of Bhitarkanika's *Heritiera* species.

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