Research & Reviews: Journal of Ecology and Environmental Sciences ISSN: 2347-7830

Invasion of Exotic Plant Species in Rural-Urban Gradient in Jharkhand, India: Their Harmful Effects and Beneficial Uses

Shambhu Nath Mishra[1], Prasanjit Mukherjee[2], Rahul Kumar[1]*

[1]Department of Environmental Sciences, Institute of Forest Productivity, Jharkhand, India
[2]Department of Botany, K.O. College, Jharkhand, India

Research Article

Received: 23-Jun-2023, Manuscript No. JEAES-23-103589; **Editor assigned:** 26-Jun-2023, Pre QC No. JEAES-23-103589 (PQ); **Reviewed:** 10-Jul-2023, QC No. JEAES-23-103589; **Revised:** 23-Aug-2023, Manuscript No. JEAES-23-103589 (R); **Published:** 31-Aug-2023, DOI: 10.4172/2347-7830.11.4.010

***For Correspondence:** Rahul Kumar, Department of Environmental Sciences, Institute of Forest Productivity, Jharkhand, India;
Email: rahulandc@gmail.com

Citation: Kumar R, et al. Invasion of Exotic Plant Species in Rural-Urban Gradient in Jharkhand, India: Their Harmful Effects and Beneficial Uses. RRJ Ecol Environ Sci. 2023;11:010.

ABSTRACT

Invasive Plant Species (IPS) is considered one of the major drivers of biodiversity loss, altering ecosystem services and socio-economic conditions through different mechanisms. However, the ecological impacts of IPS are well documented, while a few benefits of alien species were also observed. Decisions need to be made on whether benefits derived from the invasive spread of an alien species outweigh the reduced value of ecosystem services, e.g., the loss of grazing land. The present study was carried out in Gutwa village near the Ranchi smart cities, where the encroachment of invasive plants was in accelerated due to infrastructure and other anthropogenic activity. For the enumeration of Invasive Plant Species (IPS) research site has been classified into three groups

- G1 (infrastructure developed area);
- G2 (developing; infrastructure is going on) and
- G3 (undeveloped or natural vegetation dominant area).

Field data has been collected from fifteen quadrats, each of 3 m x 3 m. Quantitative analysis has been done with standard methods. Statistically, the variance of all quadrats emphasizes the dispersions nature of alien species within the group of all quadrats. The opportunity for the accidental invasion of alien species may increase with rapid urbanization and globalization. Because of this, the present study attempted to the documentation of harmful and beneficial uses of the invasive alien plant species in the rural-urban gradient in Gutwa village. So, it is necessary to consider actions to deal with the current problems in Gutwa village in Ranchi caused by invasive species and to reduce the magnitude of the problem in the future. Management prospects can be further strengthened through their linkage with geospatial technologies (remote sensing and GIS) by mapping and monitoring the IPS spread.

Keywords: Anthropogenic disturbance; Invasive plants species; Biodiversity; Encroachment; Urbanization

INTRODUCTION

There has been a rise in interest in discussing biodiversity on regional, national, and international scales. Wild plants and animals, microbes, domesticated animals and cultivated plants, and even genetic material like seeds and germplasm are all considered part of the planet's rich biodiversity [1]. Significant losses in economic value, biodiversity, and health of invaded systems are universally recognized as a result of biological invasion by non-native or alien species [2,3].

Human actions lead to the introduction and subsequent establishment of invasive alien species in new geographic regions, where they can subsequently multiply and spread. One of the biggest risks to long term preservation of ecosystem health and biodiversity is biological invasions of alien plants and poses a major threat to indigenous biological diversity. In this way, the importance of biological invasions in the global decline of biological diversity is becoming more widely acknowledged [4-7]. Alien plants have various negative effects on the environment and economy, however many of the exotic plants are of economic benefit. In general, tribal used to live in close association with nature and maintain a connection between man and the environment [8]. Local populations may benefit from the cultivation of some alien species, which might supply them with food, medicine, fuel, or fodder and some of them are responsible for the endangerment and extinction of native species and have negative impact on crop production, forest regeneration, livestock grazing, and on human health [11-13]. On the basis of the actual consequences they have, it is estimated that as many as 50% of invasive species, in general, can be classified as ecologically harmful, based on their actual impacts [9-14].

Several invasive species have made their way to India from other parts of the world over the course of many decades, whether as fodder crops or ornamentals. Rapid growth has occurred during the past fifty years due to the increasing mobility of people and things brought about by the globalisation of trade and industry, as well as the accompanying transfer of plants, animals, and microorganisms throughout the world.

Likewise, the Jharkhand, one of the biodiverse regions of India is also invaded by a variety of Invasive alien plants. Without realizing the consequences, they have been introduced into Jharkhand knowingly or unknowingly. After announcing Ranchi under the government of India's 'Smart Cities Mission' (SCM) as a Smart city, infrastructure development rapid horizontal and vertical expansion is at its peak. Gutwa village is just near the town and it is also not untouched by urbanization. Population growth is one of the major factors for the rapid expansion of the city. The messy and hidden" process of urbanization compels scholars and policymakers to look for concrete solutions to various problems such as the invasion of alien species.

Exotic alien species have a significant role in altering the global ecosystem [15,16]. The spread of species across biogeographical borders due to anthropogenic introductions of native species to new regions is one of the distinguishing characteristics of the Anthropocene epoch, where some of them colonize and naturalize by establishing self-sustaining populations and producing adverse effects on native biota. A big ecological event occurs when a region goes from having a few scattered colonists to having an overwhelming number of invaders. This shift in population can be seen as a change in demographics. Biological invasions are now a global phenomenon, deemed to be one of the foremost causes of biodiversity loss. Although they coexist with native species to create "new forests," alien species are also known to repair damaged forest ecosystems. It is even hypothesized that these novel forests might carry out ecological activities in a manner comparable to those of natural forests. It is thought that about 10% of the world's vascular plants could spread to other ecosystems and have a direct or indirect effect on them [17-20].

It has been shown by Williamson's "tens rule" that one in ten introduced species becomes established, and one in ten established species becomes a problem. Despite the fact that the number of woody plant invasions throughout the world is increasing, just 0.5%–0.7% of the world's shrub and tree species are considered to be invasive outside their natural range., Richardson and Rejmanek. There are two possible roles that invasive species might play in the process of environmental change: "Drivers" or "passengers". If they are drivers, they dominate the native diversity with their unique traits and mechanisms, but if they are passengers, they dominate the region as a consequence of anthropogenic causes like disturbances or habitat degradation. Either way, they affect the native biodiversity. They are sometimes perceived as good indicators of land use change or disturbance in a region. Invasion hotspots are mostly characterized by vegetation with less tree cover.

Exotic species that become invasive are considered to be main direct drivers of biodiversity loss across the globe. Management of Exotic Alien Species (EAS) invasion is seen as major challenge in the field of biodiversity conservation. EAS, threaten ecosystems, destroy habitats and create problems for other native species through invasion. It is believed to be the second most important factor contributing to the endangerment and extinction of species. The ecological cost is often the irretrievable loss of native species and ecosystems. It also causes heavy economic loss, in terms of reduced crop and livestock production, reduced native biodiversity, increased production costs, and so forth. Exotic Invasive Species (EIS) are species, native to one area or region, that have been introduced into an area outside their normal distribution, either by accident or on purpose, and which have colonized or invaded their new home, threatening biological diversity, ecosystems, and habitats, and human wellbeing. Biological invasion worldwide threatens biodiversity, ecosystem dynamics, resource availability, national economy, and human health studied by Potgieter. The spread of EIS is now recognized as one of the greatest threats to the ecosystem.

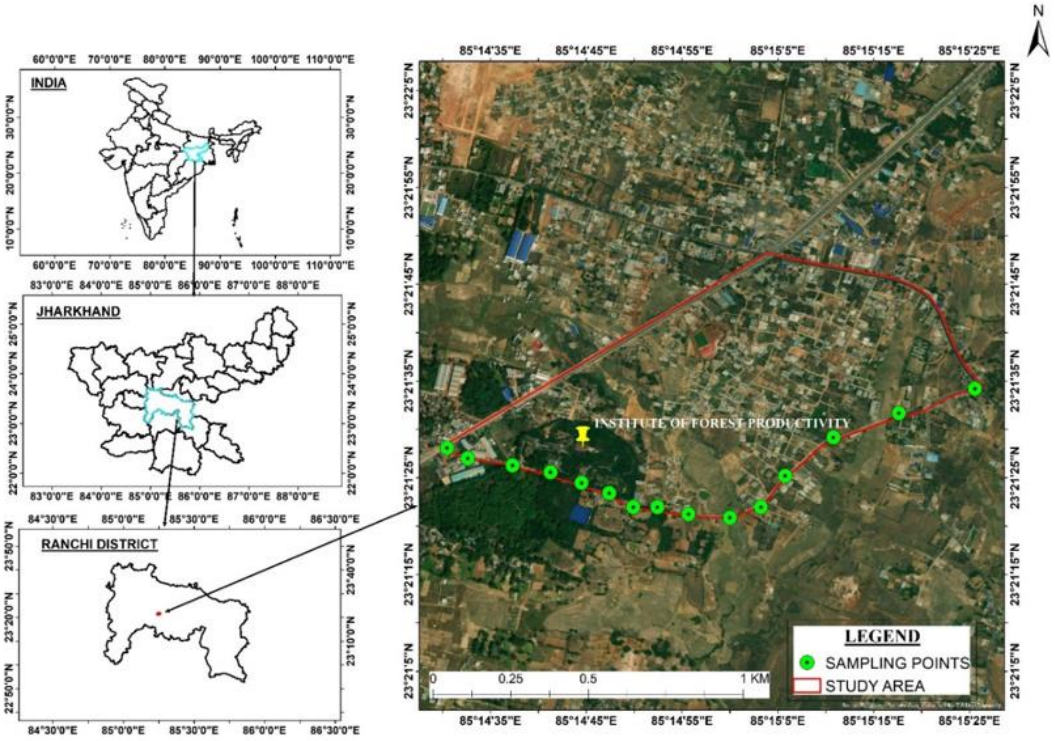
The prime objective of the present work was to report the Invasive Species Invasion (ISI) near the roadside of Gutwa village, Ranchi district, threats to vacant land near the residence area, as well as open land and forests land of Jharkhand, India. This study examined the diversity, and distributed nature of spared of invasive and native species recorded along the rural-urban gradient in the rapidly expanding city, also benefits and harmful nature of different plant species populations colonized in a rapid developmental environment. The present study aims to know about the status of invasive species in the roadside areas in the Gutwa village of Nagri block of Ranchi district, Jharkhand along with their harmful impacts as well as their beneficial uses.

MATERIALS AND METHODS

Study area

The study has conducted at Gutwa village, Nagri block of Ranchi district located on Ranchi Plateau between latitude 85°14'29.905"E to 85°15'26.861"E and 23°21'28.222"N to 23°21'34.193"N where altitude varies from 650 to 700 m above mean sea level (msl) (Figure 1). It is situated at the outer side of Ranchi city, and the outer ring is approximately one km from the study area. Gutwa village is bounded by the Ratu and Kanke blocks on the north, the Namkum block on the east, the Karra block in Khunti district on the south, and the Itki block on the west. The total geographical area of the village is 490.47 hectares. There are about 907 houses in Gutwa village, with a total population of 4835 in 2011.

Figure 1. Map of study area showing quadrats location in Gutwa village, Jharkhand.



Data collection

Sampling design: A total of 15 quadrats each of 3 m × 3 m in size have sampled in 15 grids of Gutwa village of Nagri blocks of Ranchi district of Jharkhand from September 2021 to November 2021 to sample all the Shrubs and herbs were sampled by random sampling method. All sampling sites were classified into three groups "developed area, dominant by settlements mainly building or house" categories as G1, moderately developed area infrastructure work on going called "G2" and natural vegetation growing land without anthropogenic disturbance categories as "group 3 or G3" (Table 1).

Table 1. Community characteristic of group 1, group 2 and group 3 plants species.

Quadrat nos.	Group	No. of species	Margalef in biodiversity richness index (Dmg)	Palou's evenness index	Concentration of Dominance (CD)	Effective No. of Species (ENS)	Simpson Index (SI)
Q1		11	2.43	0.91	0.15	8.86	0.85
Q2		17	3.44	0.96	0.08	14.99	0.92
Q3		13	2.84	0.92	0.12	10.64	0.88
Q4		12	2.64	0.94	0.11	10.29	0.89
Q5	G1	13	2.98	0.98	0.09	12.23	0.91
Q6		10	2.3	0.96	0.12	9.02	0.88
Q7		9	2.29	0.85	0.13	8.15	0.87
Q8		17	4.25	0.97	0.07	15.76	0.93
Q9		12	2.73	0.97	0.1	11.17	0.9
Q10	G2	12	3.17	0.96	0.11	10.74	0.89
Q11		15	3.56	0.86	0.09	13.37	0.91
Q12		20	4.47	0.92	0.06	15.7	0.94
Q13	G3	10	2.47	0.76	0.12	9.21	0.88

Q14		9	3	0.66	0.1	10.84	0.9
Q15		8	3.3	0.36	0.1	10.99	0.9

Data analyses

Vegetational quantitative assessments were conducted in accordance with Misra. The Importance Value index (IVI) is the sum total of relative density, relative frequency, and relative dominance for trees, and the same has been calculated by summing up the relative frequency, and relative density for bamboo, shrubs, and herbs. Statistical analysis of data was performed by statistical software package SPSS, Origin, and Microsoft Excel. Maps were prepared with the help of open source software Q GIS. Dispersion of the species in three different groups emphasized calculating the variance. In each group n numbers of quadrats (n=5) have been included. Scattered invasive plant species if the value of variance is low or minimum, then it is less scattered from the mean.

$$\text{Variance} = \frac{\sum(xi-x)\,2}{n-1}$$

V=Sample variance

xi=The value of the one observation

x=The mean value of all observations

n=The number of the quadrat in the group

RESULTS AND DISCUSSION

Diversity of species

A total of 1524 individual of plants of 49 species belonging to 17 families were recorded in 15 studied quadrats. According to the assessment of habitats, the major vegetation was comprised of 989 individuals (64.89%) of herbs belonging to 25 species, followed by 535 individuals (35.10%) of shrubs belonging to 24 species. Out of the total plant species, 19 were native (40.81 %) and 30 exotics (59.18 %) plant species. Among the species seven (07) in IUCN red listed species: Least concern ver. 3.1 (44 spp.) (Table 2).

Table 2. Details of native and invasive plant species recorded during study in Gutwa, Jharkhand.

S. no	Name of the plant	Habit at	Family	Origin country	IUCN red list category
1	*Achyranthes aspera* L.	Shrub	Amaranthaceae	India	
2	*Alysicarpus bupleurifolius* (L.) DC.	Herb	Fabaceae	India	Least concern
3	*Alternanthera sessilis* (L.) R. Br	Herb	Amaranthaceae	India	Least concern
4	*Alternanthera paronychioides* A. St.-Hil	Herb	Amaranthaceae	Tropical America	
5	*Amaranthus viridis* L.	Herb	Amaranthaceae	North America	
6	*Ageratum conyzoides* L.	Shrub	Asteraceae	Mexico	Least concern
7	*Bidens pilosa* L.	Herb	Asteraceae	Tropical and subtropical America	
8	*Blumea lacera* (Burm. f.) DC.	Herb	Asteraceae	India	
9	*Boerhavia diffusa* L. nom.cons.	Shrub	Nyctaginaceae	India	
10	*Commelina benghalensis* L.	Shrub	Commeliaceae	India	Least concern

11	*Senna tora* L. (Roxb.)	Shrub	Caesalpiniaceae	Central America	
12	*Senna sophera* (L.) Roxb	Shrub	Caesalpiniaceae	Tropical America	
13	*Chloris barbata* (L.) Sw.	Herb	Poaceae	Tropical America	
14	*Clerodendrum infortunatum* L.	Shrub	Lamiaceae	India	
15	*Cassia occidentalis* L.	Shrub	Caesalpiniaceae	Tropical America.	Least concern
16	*Cynodon dactylon* (L.) Pers	Herb	Poaceae	India	
17	*Crotalaria juncea* L.	Herb	Fabaceae	India	
18	*Calotropis procera* (Aiton) W.T.Aiton	Shrub	Apocynaceae	India	
19	*Dactyloctenium aegyptium* (L.) Willd	Herb	Poaceae	Africa	
20	*Emilia sonchifolia* (L.) DC.	Herb	Asteraceae	India	
21	*Eragrostis tenella* (A. Rich.) Hochst. ex Steud.	Herb	Poaceae	India	
22	*Euphorbia hirta* L.	Herb	Euphobriaceae	Tropical and subtropical America	
23	*Gnaphalium polycaulon* Pers.	Herb	Asteraceae	India	
24	*Hyptis suaveolens* (L.) Poit.	Shrub	Lamiaceae	Tropical America.	
25	*Ipomoea nil* (L.) Roth	Herb	Convolvulaceae	Tropical and sub tropical America	
26	*Ipomoea carnea* Jacq.	Shrub	Convolvulaceae	Mexico to sub tropical America	
27	*Ipomoea quamoclit* L.	Shrub	Convolvulaceae	Mexico to central America	
28	*Justicia adhatoda* L.	Shrub	Acanthaceae	India	
29	*Lantana camara* L.	Shrub	Verbenaceae	Tropical America	
30	*Ludwigia perennis* L.	Shrub	Onagraceae	India	Least concern
31	*Leonotis nepetiifolia* (L.) R. Br.	Shrub	Lamiaceae	Trop. Africa	
32	*Malvastrum coromandelianum* (L.) Garcke	Herb	Malvaceae	Tropical America	
33	*Mirabilis jalapa* L.	Shrub	Nyctaginaceae	Mexico to central America	
34	*Mimosa pudica* L.	Herb	Mimosaceae	Brazil	Least concern
35	*Ocimum sanctum* L.	Shrub	Lamiaceae	India	
36	*Paspalum scrobiculatum* L.	Herb	Poaceae	India	
37	*Pennisetum pedicilletum* Trin.	Herb	Poaceae	Tropical America.	
38	*Parthenium hysterophorus* L.	Shrub	Asteraceae	Tropical North America	
39	*Ricinus communis* L.	Shrub	Euphobriaceae	Eritrea, Ethiopia, Somalia	
40	*Saccharum spontaneum* L.	Herb	Poaceae	India	
41	*Synedrella nodiflora* (L.) Gaertn	Herb	Asteraceae	Tropical and subtropical America.	
42	*Acmella oleracea* (L.)R.K.Jansen	Herb	Asteraceae	Brazil	
43	*Sida acuta Burm*. f.	Shrub	Malvaceae	Tropical America	
44	*Sonchus oleraceus* L.	Herb	Asteraceae	Mediterranean	

45	*Solanum torvum* Sw.	Shrub	Solanaceae	Mexico to N. South America	
46	*Tridax procumbens* L.	Herb	Asteraceae	Tropical central America	
47	*Urena lobata* L.	Shrub	Malvaceae	Trop. Africa	
48	*Vitex negundo* L.	Shrub	Lamiaceae	Tropical Eastern and Southern Africa and Asia	
49	*Xanthium indicum Koenig*	Herb	Asteraceae	Tropical America	

Of the 17 families, Asteraceae is the most dominant family with 11 species followed by Poaceae (7), Lamiaceae (5), and Amaranthaceae (4). Three families namely Caesalpiniaceae, Convolvulaceae, and Malvaceae represented three species each, however, seven families have only one species.

Nature of alien species in Gutwa village

All these species recorded during the study, were reported as herbs, or small shrubs and among them, many were called as "weeds" in other countries or invasive alien plants in most of the regions. Almost 60% of plant species recorded were Invasive alien plant species. Invasive alien species such as *Parthenium hysterophorus* L., *Tridax procumbens* L. *Lantana camara* L. are aggressive invaders that thrive in disturbed regions and are responsible for a significant amount of ecological harm to India's natural areas. Invasive species like *Ageratum conyzoides* L. and *Parthenium hysterophorus* L. hasten the extinction of endangered and endemic species, decrease the carrying capacity of pastures, and raise the expense of maintaining croplands. Some of these species may have only colonised a small area, but also their potential for further spread and destruction is high. Some species may have already reached a worldwide distribution and are producing damage that's cumulative but less obvious. *Alternanthera philoxeroides*, *Alysicarpus bupleurifolius* (L.) DC. is encroaching on aquatic and riparian ecosystems, threatening the survival of native species and preventing the area from recovering. The aggressive coloniser plant known as *Parthenium hysterophorus* can be found in cultivated fields, woodlands, overgrazed pastures, waste sites, and gardens. *Dactyloctenium aegyptium*, often known as crowfoot grass, thrives in disturbed environments including cultivated fields, gardens, and roadside ditches, especially in locations where excess water pools. One of the few types of grass that can survive prolonged periods of drought as it can quickly grow and seed during the wet season. It is mostly used as food for all ruminant animals. *Pennisetum pedicellatum* is an ornamental-like grass that spreads quickly and is difficult to control. It is used as a rehabilitation approach to overcome soil degradation caused by overpopulation and unsustainable agricultural methods. This is accomplished by the usage of the method, which significantly increases the ground cover, which, in turn, reduces the amount of runoff and loss of soil. Moreover, its enormous root system helps to fortify the soil, which in turn enhances water-conservation capacities, and it makes efficient use of deeper nutrients for development.

Beneficial uses of some native plant species.

Among the many medical benefits of the *Achyranthes aspera* L. plant, which is native to India, are its antioxidant, hemolytic, anti-inflammatory, antibacterial, and antifungal characteristics. The whole plant is used for cough; an infusion of the leaf in alcohol is used for leucoderma; leaf also used as an antidote for snakebite. *Alternanthera sessilis* found along the banks of fresh water streams, canals and ponds, are rich in protein and therefore they are eaten raw as a fresh green leafy vegetable in many countries of South Asia. *Boerhavia diffusa*, which grows wild on the plains up to an altitude of 700 meters, has anti-diabetic and diuretic qualities and is also used to treat pain, inflammation, and indigestion. *Clerodendrum infortunatum* also called "Indian bhat tree" or "Ghetu/Ghato" observed along river banks and wet areas from plains to 1500 m elevation. The

leaf and root of the *Clerodendrum infortunatum* plant have been used for a wide variety of medical purposes, including as an antidandruff treatment, a fever reducer, an acaricide, a laxative, a vermifuge, an anticonvulsant, an antidiabetic, a treatment for diabetes, and a remedy for a variety of skin conditions and diseases. *Eragrostis tenella* is a weed that grows in crops, waste areas, ancient walls, lawns, roadsides, coastal dikes, and gardens with moist, black, sandier soil. *E. tenella* is grazed by cattle and water buffaloes in traditional feeding systems. *Ocimum sanctum* Linn, also called tulsi or tulasi grown for its aromatic leaves widely used in Ayurvedic and folk medicine, often as an herbal tea for a variety of ailments. It has been suggested as an effective therapy for a variety of conditions, including bronchitis, malaria, diarrhea, dysentery, skin illness, arthritis, eye disease, and insect bites, among others. *Crotalaria juncea*, or Indian hemp, natural fiber that come from it, which is used to make cordage, fishing nets, and ropes. This natural plant is helpful to farmers because of its resistance to root-knot nematodes, and it is also a crop that improves soil quality by fixing nitrogen. There are almost no known medical advantages of the Crotalaria plant, with the exception of the fact that its seeds can assist in the cleansing of both the blood and the skin. *Calotropis procera* is a well-known plant that has a history of medicinal applications for conditions including skin disease, stomatic illness, sinus fistula, and diarrhea and jaundice can also be treated using a component of the leaf.

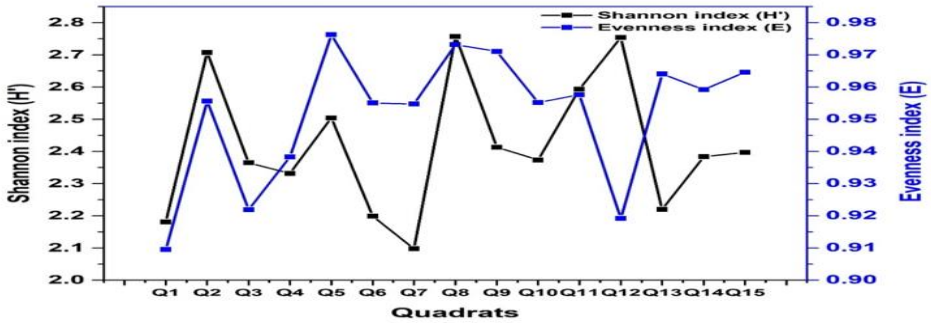
Quantitative analysis of alien species

The biodiversity of any ecosystem can be measured using distinctive tools *i.e.,* species richness, and species diversity. Shannon Weiner's diversity (H') was the highest (2.75) recorded for Quadrat (Q) 08, while the lowest (2.09) was recorded in Q7. The relationship between H and E among all quadrats showed in Figure 2.

On the other hand, the Concentration of Dominance (CD) and simpson's index for all quadrats range from 0.06 to 0.15, and 0,85 to 0.94 respectively. Similarly, Dmg and Dmn for 2.29 to 4.47, and 2.43 to 4.25, while, ENS for all quadrats was 8 to 15 respectively. Shannon Weiner diversity (H') in forests depicts the numbers of various species present in a specific area, however, the evenness index depicts how close in numbers each species exists in an environment Details of community characteristics of the Gutwa village of Ranchi showed in Table 2.

Interestingly, the species richness was highest *i.e.,* sixty-six (sum of numbers of species of all five quadrats in G1) recorded in group one site. Group 1 (G1) site was highly disturbed in terms of infrastructure development and urbanization followed by G3 and G2. G3 group quadrats were corporately rich in vegetation and free from infrastructure work. Disturbance has often been found to facilitate the establishment of invading species, while climate change may affect them positively or negatively through altering abiotic conditions, or indirectly by modifying species interactions.

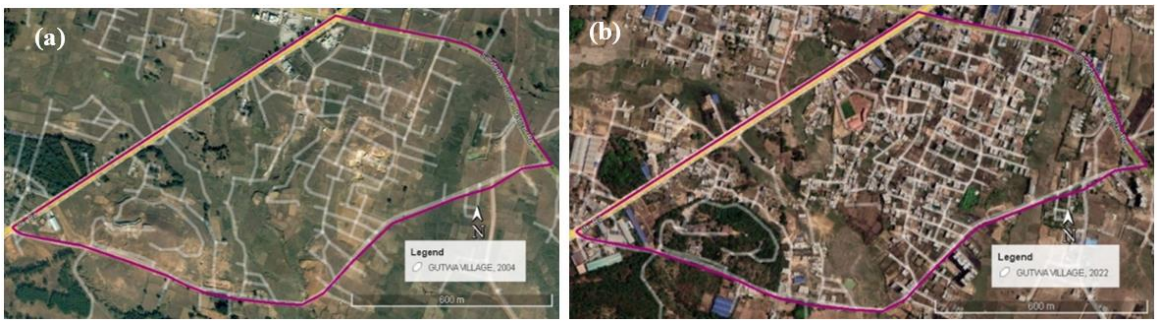
Figure 2. Relationship between Shannon Diversity (H') and Eveness index (E) among all quadrats of quadrats location in Gutwa village, Jharhand.



In comparison to the other two sites, the variance for this G1 location was quite low (4.16), coming in at 7.60 for G2 and 20.24 for G3. The low variation in G1 is a representation of the dispersed character of the invasive plant species in the study sites. The natural tendency of plants to disperse causes an increase in species richness, which helps maintain an equitable distribution of species. In other words, a great number of diverse invasive plant species have been reported in G1, but there are only a small number of individuals of each species, which is the primary cause for the high species evenness. Both the number of species and their even distribution are decreasing, which is leading to a worldwide loss of biodiversity.

Changes in land use may influence the dispersion of invasive species and the invisibility of communities by directly or indirectly promoting the spread of invasive species beyond a certain threshold degree of landscape disruption. Jharkhand is famous for its natural beauty and is endowed with roughly 40% of India's mineral reserves. Despite these natural assets, the state's infrastructure was maybe the only area in which it required improvement. However, growth at a rapid rate can have a negative impact on our native vegetation, and it also encourages the introduction of species from other parts of the world. Changes in the landscape are very visible in the picture, which was obtained from the open source platform Google earth (Figure 3). In addition to this, it has an impact on the several stages of the invasion process (e.g., dispersal *vs.* population growth) in different, potentially contrasting, ways; interacting with the distribution of invasive species to facilitate spread e.g., encouraging or modifying relationships between species in ways that make communities less visible to outside observers (e.g., edge effects).

Figure 3. Land use change mainly settlement observed between (a) 2004 to (b) 2022, might be major factor for invasion of invasive species in Gutwa village, Ranchi Jharkhand. (Image source Google earth).



Understanding the land use change due to development, and invasive species spread may thus afford new insights and opportunities for managing and restoring landscapes. So it is vital to control the spread of invasive species and minimize the invisibility of communities.

Invasive Plants Species (IPS): A global concern

It is fascinating that 5%–20% of all alien species cause problems, but their impacts on ecosystem structure and functions are persistent and are on a large scale. The negative effects of invasive species are usually multifaceted and can be anything from quite minor to extremely severe. These include, but are not limited to, the deterioration of natural ecosystems, the eradication of several native species, the eventual disappearance of these species altogether, the effects on human health, and the rising financial expenditures associated with these phenomena. The impact of invasive species on ecosystem function may be both beneficial and detrimental, and how they function depends much on the spatial-temporal environment as seen by the individuals involved. The interactions invasive species have with new environments are reason enough to study them. The invaded ecosystems are affected, either immediately or indirectly, by these interactions. Changes to the forest's structure brought on by the dominance of invasive trees have an impact on the amount of both above and

belowground carbon pools, as well as the forest's ability to store carbon, despite the fact that its effects, depending on the species, might be either good or detrimental. As argued by Padalia and Bahuguna, there exists a positive relationship between the dominance of non-native invaders and the decline of native plants. Invasive plant dominance in disturbed or open forests affects the recovery of those forests. Bioinvasions often result in altered community structure, and invasive plants may affect the faunal composition as well, especially those that are specialists by causing complete exclusion of their food plants from the invaded region. Alien species causing disturbances in the water and nitrogen cycles, transform non-fire prone areas into fire-prone. They alter the characteristics of the soil through the emission of allelochemicals and the competition for available nutrients.

However, the beneficial use of IPS has been studied by various researchers. For example, Sandilyan and Klooster drew attention to the potential health benefits of invading alien plant species. Foreign invaders plant species frequently help local people maintain their standard of living and provide for their families. They also provide a positive contribution to the function of the ecosystem by luring in pollinators and dispersion agents, both of which help to increase the biodiversity of the surrounding area and region and safeguard the soil and coastal sediment. In addition to contributing to the maintenance of various ecosystem services beyond the primary reason they were first planted (such as the provision of fuelwood, horticultural benefits, etc.). Invasive non-native species have the potential to aid in the rehabilitation of damaged forest area and enhance carbon sequestration. In India, some of the alien species (*L. camara*) are known for their current and potential benefits: Soil management, ethnomedicine, insecticide preparation, avoiding desertification and ensuring a steady supply of firewood (e.g., Eucalyptus, *Prosopis juliflora*) and water effluent treatment. Terrestrial plant-pollinator mutualisms can also be disrupted by non-native invasive species and belowground root mycorrhizal mutualisms of native species. Therefore, in addition to the fact that primary invasion, the advantages or disadvantages that an alien invader would have had were likely directly tied to its function in the new habitat, site circumstances (or needs), and also the degree to which the plant has been researched and put to use.

CONCLUSION

Rapid urbanization has heightened the danger posed by invasive plant species. The altered species composition of ecosystems is a direct result of the negative effects these species have on soil quality and land degradation. Negative effects on rural livelihoods can be seen in the early stages of an invasion caused by accidentally brought invasive plants with high growth rates. People react to elements that threaten their economic well-being and try to adjust to changes in ecosystem dynamics, thus both negative impacts and the spread of invasive species are likely to diminish with time. The invasion of plant species has prompted natural resource managers around the globe to commit significant money to control them. More extensive awareness programmes, management tactics, coordinated control efforts, and effective regulations are needed to prevent the spread of invasive species and safeguard the future security of our food supply, agricultural output, and ecological equilibrium. The control and monitoring of IPS could be:

- Taking measures to limit further harm caused by invading species; and,
- Converting to the use of commodities invading plant species as valuable resources by means of both innovation and adaptability.
- Spared awareness and decision-making programmers.

In order to effectively manage and eliminate invasive plant species, it will be necessary to collect and analyse new data over the course of the next several years and to develop a comprehensive interdisciplinary strategy at the administrative and

scientific levels.

FUNDING

"The authors declare that no funds, grant or other support were received during the preparation of the manuscript"

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the study's conception and design. Data collection was performed by S.N Mishra and Prasanjit Mukherjee and Rahul Kumar. Materials and Methods design by SN Mishra. The first draft of the manuscript was written by Rahul Kumar and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

REFERENCES

1. Kumari P, et al. Exotic species invasion threats to forests: A case study from the Betla national park, Palamu, Jharkhand, India. Trop Plant Res. 2016;3:592-599.
2. Hulme PE, et al. Biological invasions in Europe: Drivers, pressures, states, impacts and responses Biodiversity under threat. R Soc Chem. 2007:292.
3. Wittenberg R, et al. Invasive alien species: A toolkit of best prevention and management practices. CAB international, Wallingford, UK. 2001.
4. Westman M, et al. The relationship between stress and performance: The moderating effect of hardiness. Hum perform. 1990;3:141-155.
5. Tyser RW, et al. Spotted knapweed in natural area fescue grasslands: An ecological assessment. Northwest Sci. 1988;62.
6. McGeoch MA, et al. Global indicators of biological invasion: Species numbers, biodiversity impact and policy responses. Divers Distrib. 2010;16:95-108.
7. Simberloff D, et al. Impacts of biological invasions: What's what and the way forward. Trends Ecol Evol. 2013;28:58-66.
8. Saikia P, et al. Wild edible plants of Jharkhand and their utilitarian perspectives. Indian J Tradit Knowl. 2020;19:237-250.
9. Rangel-Landa S, et al. Ethnoecology: Plant management and biocultural heritage in Oaxaca, Mexico. J Ethnobiol Ethnomed. 2016;12(1):1-83.
10. Linder T, et al. Making the case for edible microorganisms as an integral part of a more sustainable and resilient food production system. Food sec. 2019;11:265-278.
11. Shrestha BB, et al. Community perception and prioritization of invasive alien plants in Chitwan-Annapurna landscape, Nepal. J Environ Manage. 2019;229:38-47.
12. Nentwig W, et al. The Generic Impact Scoring System (GISS): A standardized tool to quantify the impacts of alien species. Environ Monit Assess. 2016;188:1-3.
13. van der Veer G, et al. Environmental and economic impact assessment of alien and invasive fish species in Europe using the generic impact scoring system. Ecol Freshw Fish. 2015;24:646-656.

14. Richardson DM, et al. Naturalization and invasion of alien plants: Concepts and definitions. Divers Distrib. 2000;6:93-107.
15. Panetta FD, et al. Managing for biodiversity: Impact and action thresholds for invasive plants in natural ecosystems. NeoBiota. 2017;34:53–66.
16. Pysek P, et al. Invasive species, environmental change and management, and health. Annu Rev Environ Resour. 2010;35:25-55.
17. Lewis SL, et al. Defining the anthropocene. Nat. 2015;519:171-180.
18. Steffen W, et al. The anthropocene: From global change to planetary stewardship. Ambio. 2011;40:739-61.
19. van Kleunen M, et al. Global exchange and accumulation of non-native plants. Nature. 2015;3;525:100-103.
20. Yang Q, et al. The global loss of floristic uniqueness. Nat Commun. 2021;12:1-10.