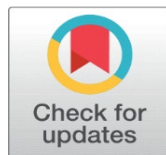
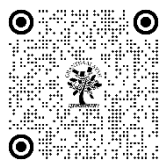


WILDLIFE PHOTOGRAPHY AND BIODIVERSITY CONSERVATION WITH SPECIAL REFERENCE TO INDIA

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ABSTRACT

Photography has been a source of hope and expectation among scientists. It is considered a unique medium that has opened novel scientific observations and experimentation possibilities. Capturing the changes and details repeatedly through the camera's lens forms a remarkable scientific research tool. It allows one to document the most important characteristics of any living animal and its actions. The most powerful tool for documenting biodiversity is photography. The images taken of animals or 'life', in other words, serve as the 'voucher', and this virtual specimen, to a certain extent, is more valuable than the whole organism. It conquers the degradation effects of preservation. Nature, wildlife and underwater photography inspire conservation. Wildlife photography has emerged as a critical tool in promoting biodiversity conservation, particularly in megadiverse nations like India. This paper explores its role in raising environmental awareness, influencing conservation policy, supporting scientific research, and fostering public stewardship. This paper also discusses a few case studies from India, which show the power of wildlife photography's transformative potential. The paper argues for its formal recognition as a strategic conservation tool and recommends collaboration among scientists, photographers, policymakers, and communities.

Keywords: Photography, Image, Observation, Wildlife, Conservation



1. INTRODUCTION

The process of using light to create images is called photography. It is most famous for capturing memories and moments. Because it has long been viewed as both "the art of science" and "the science of art," photography also plays a part in the multidisciplinary fields of "art" and "science." The four themes of the photography approach include observation, experimenting, archiving, and the relationship between scientific and artistic photography. It is well recognised that photography may build a relationship of trust with scientific methods.

Additionally, it is seen as a mediator in the continuous exchanges between representative techniques and creative and scientific concepts. Numerous fields, including industry, medical, astronomy, archaeology, scientific research, graphic design, law enforcement, animation, and many facets of modern life, have found practical uses for photography. The application of science in all its facets, particularly chemistry and physics, is called the science of photography. In order to shoot and develop images correctly, this pertains to the camera, the physical functioning of its optics, the electronic components of the camera, and the entire film development process (Kiesecker, 2013). Among other things, photography has become a technology that enables us to record or capture reality clearly. Photographs were employed as a source of knowledge since they were thought to be unique proof of a location or a historical event. This made photography a crucial component of biology and conservation.

Gombozhab Tsybikov, a Russian explorer who travelled to Tibet between November 1899 and April 1902 with funding from the Russian Geographical Society, captured some of the first series of photographs ever published in large quantities. In 1905, National Geographic Magazine featured some of his photos and those taken by Ovshe Norzunov, a traveller from Kalmyk. They depicted the enigmatic metropolis of Lhasa, Tibet's political and religious hub, which was at the time a far-flung location that most people were unaware of. The social influence of their images was enormous. This led National Geographic to keep releasing images in a revolutionary visual style, planting the roots for the magazine's eventual global renown a few decades later. This was one of many instances of the photographic camera's great documentary value. Since Nicéphore Niépce's successful experiments in 1824, Louis-Jacques Mandé Daguerre's invention of the daguerreotype (a technique that captured a real, high-resolution image on a copper plate) in 1839 and William Henry Fox Talbot's invention of the calotype (the first negative-positive process) in 1841, the technology has been continuously developing. They compared with Charles Bennett, Richard Maddox, and John Herschell.

Since its inception, photography has been a vital documentary tool, communicating biodiversity research and conservation projects (Ambrosia, 2009; Berger & Ehrhardt, 2018). Technological advancements have enabled its use in scientific data collection and public engagement through citizen science programs (Norouzzadeh et al., 2018). Nature photography's versatility allows for the specialisation of subjects ranging from journalistic documentation to fine art (Kadur & Anand, 2019). Combining talent with environmental commitment, conservation photography is increasingly central to citizen science and communication (Kiesecker, 2013; Mittermeier et al., 2014).

Globally, wildlife populations face unprecedented extinction rates, with over 1 million species predicted to disappear in the coming decades, threatening environmental and human well-being (IPBES, 2019; Ceballos et al., 2020). Conservation organisations, including nonprofits and research hubs, contribute through habitat management, research, and outreach (Groom et al., 2006). Many leverage social media to advocate for conservation, amplifying their reach (Sandbrook et al., 2018). One of 17 megadiverse countries, India faces biodiversity threats from urbanisation, habitat fragmentation, pollution, and climate change (Gadgil & Guha, 1992; Pimm et al., 2015). Wildlife photography has evolved from a hobby into a medium for storytelling, activism, and documentation. Social media has exponentially increased its impact, fostering public engagement and policy dialogue (Sandbrook et al., 2018).

This paper analyses wildlife photography's role in biodiversity conservation, exploring historical developments, current practices, and future contributions. It draws on the author's experiences as a zoologist and hobbyist photographer, noting how photographing wildlife enhances environmental awareness.

2. PHOTOGRAPHY AND ITS RELATION WITH SCIENCE

As a primary tool for documenting biodiversity, photography captures observations critical to discoveries like evolutionary theory (Berger & Ehrhardt, 2018). Known as the "Scientist's Passionate Art," photography supports the scientific cycle of observing, recording, and analysing (Ambrosia, 2009).

Different types of photography important for Conservation in Science

1) Digital photography

Digital photography is a very sound form of still photography. To examine the Earth's surface, scientists employ digital photos taken from orbit; to study other planets and moons, they use different remote sensing tools. In many cases, the digital picture format is used for identification and analysis. Often referred to as "digital negatives," these digital formats are the files that retain the majority of the information from the photographed image. This comes after its validity has been confirmed. Digital photography is similar to traditional photography in many ways. However, a digital camera is connected to a computer or a printing device rather than processing film at a photo lab. With the right computer and software skills, images can be easily downloaded and emailed, and they are utilised in computer presentations. Digital photography is a quick and reliable tool in the scientific community.

2) Time-lapse photography

Motion photography uses a technique known as "time-lapse" photography. It focuses on filming a particular subject continuously at various points in time. It is a sophisticated method in which the frequency of film frame capturing is significantly lower than the frequency of sequence viewing. Playing at a regular pace makes time pass more quickly, which causes it to pass. By taking many pictures on a strip of film regularly, this type of photography captures very slow processes, such as a flower's withering or blooming. After that, the movie is shown at standard speed. It is the cinematic photography method. Time-lapse photography documents animal migration or breeding patterns, providing insights

into phenology and climate change impacts. Time-lapse videos visualise slow processes (e.g., glacier retreat), raising awareness of environmental change (Kiesecker, 2013). Time-lapse photography offers longitudinal data for studying ecological dynamics and climate impacts, often used in citizen science (Norouzzadeh et al., 2018).

3) Camera Trap Photography

Camera traps are automated cameras triggered by motion or heat sensors, capturing images or videos of wildlife in their natural habitats without human presence. They are typically deployed in remote or inaccessible areas. Camera traps provide data on species presence, population size, and behaviour, which are critical for assessing conservation status (Burton et al., 2015). They minimise disturbance to wildlife, enabling long-term studies of shy or nocturnal species. Camera traps help detect illegal activities in protected areas, supporting enforcement (Wang & Macdonald, 2009). Generates quantitative data for species distribution models and ecological studies, often processed with AI for species identification (Norouzzadeh et al., 2018).

4) Macrophotography

This type of photography highlights the smallest aspects of the subject. Insects and flowers provide excellent macro-photography subjects. Gaining a broader and more intimate perspective aids in comprehending the subtleties. It covers various topics, including lighting, flash, tripods, close-ups, lens reversing, and camera gear. Macro-photography can open our eyes to a whole new, small universe. Through macro photography, objects typically invisible to the naked eye appear stunning. It records underrepresented species, like microfauna or flora, contributing to taxonomic inventories (Berger & Ehrhardt, 2018). Macro images engage the public by showcasing the beauty of lesser-known species, fostering appreciation for biodiversity (Kadur & Anand, 2019).

5) HDR (High Dynamic Range) photography

HDR photography encompasses a broad range of picture production, as the name suggests. It all comes down to taking three distinct kinds of pictures and combining them to create science photos with striking contrasts. The ability to replicate a wider dynamic range of luminance than is achievable with conventional digital imaging techniques is sometimes referred to as HDR. It seeks to increase the "dynamic range," or live ratio of light to dark in photography, of images. Automatic capture produces stunning results while photographing in HDR. Alternatively, the camera could be mounted on a tripod, but it needs to be kept stationary. In addition to the aforementioned photography approaches, numerous more vital techniques help us comprehend the various facets of life science, such as underwater and high-speed photography.

6) Aerial Photography (Including Drone Photography)

Aerial photography captures images from above using drones, helicopters, or satellites. Drones, in particular, have become affordable tools for high-resolution imagery in conservation. Aerial images monitor deforestation, land-use changes, and habitat fragmentation, as seen in the Save the Western Ghats Campaign (Gadgil & Guha, 1992; Koh & Wich, 2012). Drones count large or dispersed populations, such as migratory birds in extensive wetlands and migratory animals in great migrations. Aerial photography also highlights human impacts, like mining or urbanisation, aiding policy advocacy (Mittermeier et al., 2014). It provides spatial data for GIS analysis and remote sensing, enabling large-scale ecosystem monitoring (Collin et al., 2018).

7) Underwater Photography

Underwater photography uses specialised equipment to capture marine and freshwater ecosystems and document aquatic species and habitats. It plays an important role in Marine Conservation by documenting coral reefs, fish populations, and marine pollution, supporting coastal conservation (Collin et al., 2018). It can also track endangered aquatic species and capture data of degraded aquatic habitats (e.g., plastic pollution), driving regulatory action (Mittermeier et al., 2014).

8) Citizen Science Photography

Citizen Science Photography involves non-professionals using personal devices (e.g., smartphones) to capture images for conservation projects, often coordinated through platforms like eBird, iNaturalist, etc. It helps collect large-scale data on species distribution, as seen in various biodiversity surveys (Norouzzadeh et al., 2018). It plays an important role in encouraging public participation and fostering stewardship. It supplements professional research with crowd-sourced images, enhancing monitoring efforts (Sandbrook et al., 2018).

9) Documentary and Advocacy Photography

This kind of photography mainly focuses on storytelling through compelling images of wildlife, habitats, or human-wildlife conflicts. It is often used in media and campaigns. It greatly helps in evoking emotional responses amongst its viewers. It also provides visual evidence for legal and governmental interventions and supports conservation organisations by showcasing urgent issues.

10) Pivot photography in Life Sciences

The different techniques of photography, undoubtedly, enable the scientific mechanisms in proximity. However, the 'Pivot photography' that makes 'Life-sciences' possible in the true sense, includes two broad fields, viz., 'Nature photography' and 'Wildlife photography'. Most of the aspects are covered under these types. Pivot photography refers to photographic techniques that capture images from a fixed or rotating vantage point to monitor, analyse, or document biological phenomena over time or space. This could include time-lapse photography, 360-degree panoramic photography, or repeated imaging from a consistent position to track changes in ecosystems, species behaviour, or experimental setups. It is valuable for temporal analysis, documenting specific locations or subjects from identical angles for comparative studies and minimising disturbance to wildlife or experimental conditions.

3. PHOTOGRAPHY AS A CORNERSTONE OF CONSERVATION

By the late 20th century, photography's accessibility aligned with environmental movements, becoming a key dissemination tool (Groom et al., 2006; Mittermeier et al., 2014). Conservation-focused projects emerged globally, with photographers like Emmet Gowin using aerial perspectives in the 1970s to highlight human impacts (Mittermeier et al., 2014). Early mass-published images, such as Gombozhab Tsybikov's Tibet photographs (1899–1902), raised awareness of remote ecosystems (MacKenzie, 1988).

The IUCN, founded in 1948, has prioritised photography for environmental communication (Groom et al., 2006). Dian Fossey's work on Virunga gorillas, supported by Robert M. Campbell's 1970 National Geographic photographs, debunked myths and secured anti-poaching funds (Fossey, 1985). Jane Goodall and Biruté Galdikas similarly used photography to advocate for primate conservation, with images by Hugo van Lawick and Ron Brindamour fostering public support (Ross et al., 2011).

One of the primary functions of photography for nearly all photographers is that photos help them to recall events (Markwell, 1997; Boulanger et al., 2016). It has been well-documented that people value and get more out of experiences than physical objects (Packer, 2006; Ballantyne et al., 2010; Kruger & Saayman, 2010). Similarly, photos of wildlife may reinforce memories with those animals, and indirectly, may reinforce any conservation or educational messages about the animals or the environment (Schanzel & McIntosh, 2000). People often take photos to prove that they have participated in some experience; in other words, photos help us remember an experience ourselves, allowing us to share that memory with others (Prideaux & Coghlan, 2010). Photography is increasingly a social activity, focused more on communicating with friends, sharing experiences, and identity formation (van Dijck, 2008). Most of this photo-based communication now takes place online using services like Instagram, Facebook, and Snapchat. These services allow their users to share photos, socialise, and get feedback on their images, which often drives them to produce more photos, leading to more socialising (Cox et al., 2008). The increasingly social nature of photography is promising for spreading awareness of and interest in wildlife and biodiversity.

Visual imagery shapes public understanding of environmental issues, evoking stronger responses than text (Lester, 2006). Wildlife photography bridges scientific abstraction and public perception, leveraging humans' connection to animals (Eddy et al., 1993; Myers et al., 2004). Engaging photographs increase emotional attachment, awareness, and concern for biodiversity loss, motivating action (Kals et al., 1999; Vining, 2003; Allen & Ferrand, 1999; Grace & Ratcliffe, 2010). Wildlife photography fosters empathy and conservation behaviour, notably through local species engagement (Wilson, 1984; Hunter & Brehm, 2003).

4. HISTORY AND EVOLUTION OF WILDLIFE PHOTOGRAPHY IN INDIA

Wildlife photography in India has evolved from a colonial pastime into a conservation medium, reflecting changing human-nature relationships (Kadur & Anand, 2019).

- 1) **Colonial Roots: The Beginnings (19th century):** In the late 1800s, photography was an elite hobby for British officers, capturing hunted animals as trophies. Despite cumbersome equipment, early records of tigers and elephants emerged (MacKenzie, 1988).
- 2) **Post-Independence Shift: A New Perspective (1950s–1970s):** Post-1947, Indian photographers embraced wildlife photography with admiration for nature. Roll film cameras and telephoto lenses increased accessibility (Krishnan, 1959; Berger & Ehrhardt, 2018). M. Krishnan's photographs and essays sparked conservation interest (Krishnan, 1959).
- 3) **The Conservation Era: Awakening and Activism (1970s–1990s):** The 1973 Project Tiger launch catalysed advocacy photography (National Tiger Conservation Authority, 2019). Photographers like Kalyan Varma documented vanishing species, supporting policy and national parks (Sahgal, various issues; Varma, n.d.). Sanctuary Asia bridged science and public awareness (Sahgal, various issues). SLRS and faster films enhanced flexibility (Berger & Ehrhardt, 2018).
- 4) **Digital Revolution and Democratisation (2000s–Present):** The 21st century introduced DSLRS, drones, and trail cameras, expanding photography's reach (Ivosevic et al., 2015; Koh & Wich, 2012). Social media provided global exposure, fostering hobbyist communities (Shivaram, n.d.). Photography tours boomed in parks like Ranthambore, with photographers like Rathika Ramasamy blending science and art (Mukherjee, n.d.; Shivaram, n.d.; Sandbrook et al., 2018).

5. CASE STUDIES OF WILDLIFE PHOTOGRAPHY AND BIODIVERSITY CONSERVATION FROM INDIA

Here are the few case studies from India are being discussed where wildlife photography has played a major role in conserving the biodiversity of Indian wildlife.

- 1) **The Save the Western Ghats Campaign (1987–88):** The Western Ghats faced deforestation and mining threats. Photographers like T. N. A. Perumal documented degradation during the Save the Western Ghats March, influencing protected areas like Silent Valley National Park and inspiring NGOS like ATREE (Gadgil & Guha, 1992; ATREE, n.d.).
- 2) **The Story of the Amur Falcon – Nagaland (2012–2013):** Photographers Ramki Sreenivasan and Shashank Dalvi exposed Amur Falcon hunting in Nagaland, leading to a 2013 ban and eco-tourism shift, earning the title "Falcon Capital of the World" (Conservation India, 2013).
- 3) **Save the Slender Loris – Tamil Nadu:** ATREE photographers used camera traps to document the Slender Loris. Community exhibitions reduced superstition-driven killings, supporting habitat preservation (ATREE, n.d.; Sarkar & Montoya, 2011).
- 4) **Snow Leopards and the Himalayan Camera Trap Initiative (2019–2021):** Sandesh Kadur and Dhritiman Mukherjee's camera-trap photography supported India's Snow Leopard Population Assessment, informing GSLEP conservation.
- 5) **Wetlands and Bird Migration in Bharatpur:** Photographers Rajesh Bedi and Mansingh Rathore documented declining bird populations in Keoladeo National Park, leading to legal interventions and Ramsar designation (UNESCO, 2005).

6. CONCLUSION

Photography today, along with its art and science aspects, has the beauty that anyone with even a little skill can take photographs, tell a story, and contribute to conservation projects that matter to them. It requires patience, waiting for conditions to be perfect before making an exposure and capturing an image. Images thus created and captured are aesthetically appealing and can be used for further environmental and cultural conservation.

On the other hand, conservation photography is the active use of the photographic process. Also, the 'Conservation biology' is the science of protecting and managing biodiversity. Presenting sound evidence, graphs, charts, tables, and data should be enough to convince policymakers and the public about the benefits of conservation. Photography combined with sounds was proposed as a viable alternative to gathering endangered species. However, neither the

authors nor the International Code of Zoological Nomenclature mentions any parameters for using such tools, which, individually, may be unreliable.

Evidence shown and data collected over weeks in the field support participation in conserving natural resources through photography. Photographs act as ambassadors for conservation projects around the world. They speak louder than any number of words in a report sitting unread on a desk. The high quality of the photography provides high credibility to the published material.

Thus, photography can play a critical role in calling attention to threats faced by the natural world. Photographs can give a voice to species and wildlife facing danger globally due to pollution and climate change. Wildlife photography in India is a vital conservation tool, bridging science and storytelling. Its evolution reflects ecological consciousness, with the camera inspiring protection of the wild. Institutionalising its role can enhance India's conservation efforts.

CONFLICT OF INTERESTS

None.

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